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# Clitocybe Mushroom Rot of Citrus Trees and Other Woody Trees In Florida

By Dr. Arthur S. Rhoads, Associate Plant Pathologist, Cocoa Laboratory of the Florida Agricultural Experiment Station. Address delivered at Farmers' and Fruit Growers' Week at Gainesville,, August 12, 1931.

At the meeting of the Florida State Horticultural Society in 1930 the speaker presented observations on some new or little known citrus diseases, among which Clitocybe mushroom root rot was reported for the first time as attacking citrus trees.\* In view of his especial interest in this new citrus disease, an effort was made to secure as much additional information as possible whenever an opportunity occurred. Since a more intimate knowledge of this disease whose cause has remained shrouded in obscurity and confused with foot rot for so long will be of interest to growers, the observations on it to date will be presented for their benefit.

## Occurrence in Florida

Clitocybe mushroom root rot,



Fig. 1.—Grapefruit tree attacked by Clitocybe mushroom root rot. No basal bark lesion present but disease was located by observing old dried clusters of mushrooms at the base of tree.

which is known to attack fruit trees, grapevines, forest, shade and ornamental trees, and shrubs, occurs in a number of the southern states ranging from Florida and North

Carolina on the Atlantic Coast west to Missouri, Oklahoma and Texas. Numerous cases of this disease have been recorded by the speaker, during the past 8 years, on a large variety of woody plants from various parts of Florida, where it has been known to occur since 1902. However, it was not until December, 1929 that definite evidence was secured that citrus trees are also attacked by this root rot fungus. Specimens of the diseased roots sent at that time from Lake Alfred led to a visit to the grove in question in order to secure first hand information in regard to the occurrence and extent of this trouble. Here the mushroom root rot was found to occur on grapefruit trees, about 15 years of age, on rough lemon stock. During the approximately 7-year-period that the present owners have had this grove they noted that an occasional tree had died on an area of about a half-acre. Their attention was first called to foot rot at the root crown but, later, in digging under a number of the trees to investigate the condition of the root systems, the tap roots and many of the lateral roots were found to be dead, even on trees which did not show any

\* Rhoads, Arthur S. Some new or little known citrus diseases observed during the past year. Proc. Florida State Hort. Soc. 1930: 80-88, 1930; also in Citrus Industry 11 (8) 3-7, 34, & 48. May, 1930.

basal lesion suggestive of foot rot or any particular decline of the top. When the trees were visited in January, 1930, several old detached dried up clusters of the mushrooms of the *Clitocybe* root rot fungus were still in evidence under some of the trees. Many of the more recently attacked roots that were examined exhibited the characteristic mycelium of this particular root rot fungus between the bark and the wood and had the usual mushroom rot fungus odor. Pure cultures of the *Clitocybe* root rot fungus were obtained from the root specimens received by the speaker in December.

In March, 1930, the speaker's attention was called to a basal bark trouble on a few grapefruit trees about 20 years old on rough lemon stock in a grove at Georgiana on Merritt's Island. The cause of the trouble was not apparent at the time the trees were hastily visited incidental to other activities but the bark at the bases of the trees was cracking and gumming and the

6 trees it was found that a considerable proportion of the roots near the surface were dead, the bark being more or less rotted. In a close inspection of the other trees in this part of the grove, which was one corner next to a piece of cut-over woods, it was found that several other trees with good tops and fruit crops exhibited basal lesions closely resembling foot rot. The majority of the trees on an area of approximately a half-acre in this corner of the grove appeared to be so affected. During a rainy period in April the examination of a large lateral root on one of the trees that was dying rapidly from girdling revealed a luxuriant development of white mycelium under the water-soaked bark and some of the cultures from this yielded the *Clitocybe* root rot fungus with its characteristic production of rhizomorphs. In June, the dirt was dug away from under this tree sufficiently to expose the portions of the lateral roots adjacent to the root crown. About two-thirds of these lat-

months but there was no evidence of any bark lesion at the base of the trunk and only one small dead root was found when the root system was investigated later. In the residential part of this property, 2 young clusters of the mushrooms of the *Clitocybe*

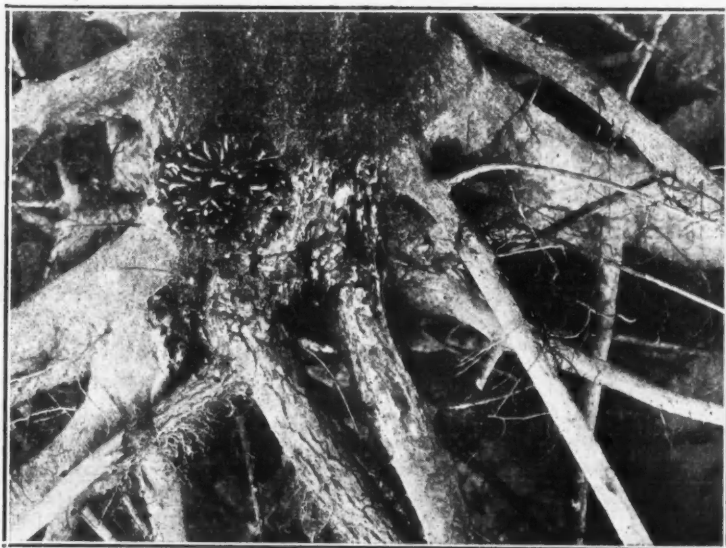


Fig. 2—Valencia orange tree with young cluster of mushrooms at base, showing dead bark on root crown and roots after removing soil.

trouble bore some resemblance to foot rot. Of the 4 trees first observed, one had died recently, while 3 others nearby were more or less completely girdled, with the tops fully half dead and bloom profusely, and the leaves yellow and exhibiting the symptoms of acute starvation characteristic of trees practically girdled. The worst one of these trees died within a period of a month. Two additional declining trees were observed on a subsequent visit to the grove to have basal lesions closely resembling foot rot. On each of these

eral roots were found to be dead and most of these exhibited the characteristic development of the mycelium of the *Clitocybe* root rot fungus. This organism was again isolated in cultures made from these roots. These trees were visited at frequent intervals during the fall and winter to look for the development of the clusters of the mushroom-like fruiting bodies but only one cluster was observed on November 20 at a point 9 inches from the base of the corner tree. This tree had showed a rather weak condition of the top for several



Fig. 3—Base of young guava tree attacked by *Clitocybe* mushroom root rot, with bark cut away to show the development of the mycelium of the fungus between the bark and the wood.

*tochybe* root rot fungus were observed at the base of a large turkey oak (*Quercus catesbaei*) at one corner of the garage. This tree had been dying for some years, the activity of a heart-rot fungus being apparent and *Clitocybe* root rot being suspected when the tree was first observed.

Late in November, 1930, the speaker was called over to Lake Alfred to investigate the occurrence of *Clitocybe* root rot on 6 tangerine trees in a grove diagonally across the road from the grove visited in January to make observations in regard to the occurrence of this root rot trouble. The tangerine grove was about 9 years of age and on rough lemon stock. The attacked trees were located solely by finding the clusters of the mushroom-like fruiting bodies of the fungus at the bases. Two of these trees occurred on one side and

September, 1931

one on the other side of a tree that had been removed and replanted the preceding year. Another tree occurred in the next row opposite one of these attacked trees and the other 2 occurred in rows nearby. After these trees were excavated and treated a hasty survey disclosed the occurrence of the fruiting bodies of the *Clitocybe* root rot fungus at the



Fig. 4.—Grapefruit tree dying from girdling by the *Clitocybe* mushroom root rot fungus, showing basal bark lesion closely resembling a foot lesion.

bases of 3 Valencia orange trees and a grapefruit tree of like age and on the same rootstock in an adjoining grove under the same management. Fruiting bodies of this fungus were later found at the base of a grapefruit tree on the other side of Lake Alfred in a grove 15 or 16 years old, occurring next to where a tree had been removed and replanted recently. While digging under the last-mentioned tree to prepare it for treatment, one of the workmen remarked that he had observed a cluster of the same kind of mushroom on an orange tree nearby in July and stated that at that time he had cut out part of the tap root, which was dead. This tree, which proved to be a Ruby Blood orange, was found to have 2 fresh clusters of the fruiting bodies of the *Clitocybe* root rot fungus which had developed from the cut portion of the tap root under the base of the tree.

After the speaker's departure from Lake Alfred, a detailed inspection was made of the remaining groves under the same management,\* and a large number of additional trees at-

## THE CITRUS INDUSTRY

Seven

tacked by the *Clitocybe* root rot fungus were located during December and the first half of January by finding either young or old clusters of the mushrooms of this fungus at the bases. When at Lake Alfred again late in January, 1931, the speaker, in checking up on the developments since his previous visit, learned that 53 additional attacked trees on rough lemon rootstock had been located and treated. With the

tangerine tree in the block where 6 of these trees were found to be attacked late in 1930. These, together with the 12 trees located to start with, make a total of 70 trees attacked by *Clitocybe* root rot out of a total of forty odd thousand trees or approximately 700 acres of grove under one management. Since these groves average about 60 trees per acre, the total number of attacked trees would comprise slightly better



Fig. 5— Mature cluster of mushrooms of the *Clitocybe* root rot fungus fruiting at base of recently killed young Australian pine tree.

exception of 9 orange trees, these were all grapefruit trees. These attacked trees ranged in age from about 12 to 18 or 19 years. They were divided among 6 different groves respectively as follows: 1, 5, 2, 2, 5, and 39. Early in 1931, 5 additional citrus trees were found to be attacked by *Clitocybe* root systems dying, while the fifth was a

than one acre out of the 700.

While in the Lake Alfred section late in November, 1930, the speaker visited a grove at Lake Hamilton to confer with the owner in regard to gummosis developing on a number of his trees. One of the trees to which the grower conducted him merely showed a slight exudation of gum at one side of the root crown, which

\* The speaker is indebted to Mr. S. F. Poole, vice-president of the Florida State Horticultural Society and prominent grove owner and manager of Lake Alfred, for his valued cooperation and interest manifested in the treatment of these trees.



suggested the possibility that *Clitocybe* root rot might possibly be the cause of the trouble. Upon scraping away the soil and cutting away the bark on one of the larger lateral roots just below the exudation of gum a good development of the mycelium of this root rot fungus was found. The tap root and some of the other lateral roots on this side of the tree were found to be dead. This tree was a grapefruit tree about 16 years of age on rough lemon stock. The top of the tree did not exhibit any evidence of decline.

While in the central part of the peninsula again late in January, 1931, the speaker was hastily conducted to a grove at Winter Haven to examine an orange tree about 18 years of age on rough lemon stock, which it was thought might be attacked by mushroom root rot rather than foot rot. The top of the tree had not died back perceptibly but the foliage had a dull lifeless appearance and it looked as though the growth of the tree was at a standstill and that it would not develop the spring flush of growth. The base of the trunk had two decorticated lesions extending up about 9 inches above the ground and closely resembling an old case of foot rot. No mushrooms were present and the brief amount of time available did not afford the opportunity of digging around this tree but cutting away the bark on some of the dead lateral roots at the surface disclosed the characteristic mycelium of the *Clitocybe* root rot fungus. Several trees in this grove were said to have died from foot rot and quite a few had been removed in the past but lack of time did not permit examining additional trees. It was learned subsequently that a large proportion of the roots on the tree in question were found to be dead upon removing the soil for treatment and that it fell over afterward.

In the latter part of April a trip was made to inspect groves at Highlands City, in Polk County, where one of the speaker's colleagues at the Citrus Experiment Station at Lake Alfred had found a number of citrus trees dying from what appeared to be *Clitocybe* root rot. Upon being conducted to the grove in question, it was found that 34 trees out of 384 on the first 16 rows inspected at that time were attacked and had been treated after removing the soil from about the root crowns. Forty-eight trees in this 10-acre block had been removed previously on account of decline from a trouble thought to be foot rot. The grove was on hammock land, the trees be-

ing on rough lemon stock. From the appearance of the roots removed previously on account of decline from a trouble thought to be foot rot. The grove was on hammock land, the trees being on rough lemon stock. From the appearance of the roots removed from the treated trees and the way in which the disease worked, there was no doubt but that it was *Clitocybe* root rot rather than foot rot.

Another grove under the same management was visited and it was found that the same trouble was present although no trees had been lost. This grove was also on rough lemon stock, the trees being grapefruit trees planted about 12 — 14 years ago on land where oak trees were numerous. None of these trees showed any evidence of decline but hasty digging disclosed the fact that the *Clitocybe* root rot fungus had already made great headway on the root systems of over a dozen trees which showed no external symptom of the disease other than possibly a slight pallid condition of the foliage or an insignificant gumming spot at the bases of the trunks.

On most of these attacked trees examined the tap roots were dead and extensively invaded by the mycelium of the *Clitocybe* root rot fungus and large patches of bark with a luxuriant development of the mycelium of this fungus could be sliced from the sides of the lateral roots at the root crown. Infected oak roots were also discovered under some of these trees in the scanty digging done at the time of the inspection. Pure cultures of the *Clitocybe* root rot fungus which developed an abundance of the usual rhizomorphs were secured from material taken back to Lake Alfred for this purpose. Seven out of 10 subcultures made in large test tubes either had developed miniature clusters of the mushrooms of this fungus or had begun their differentiation within a period of 6 weeks. From the frequency with which trees attacked by the *Clitocybe* root rot fungus were found in this locality, it is strongly suspected that a systematic survey of the numerous groves in this section, especially in the fall months when the development of the clusters of the mushroom fruiting bodies at the

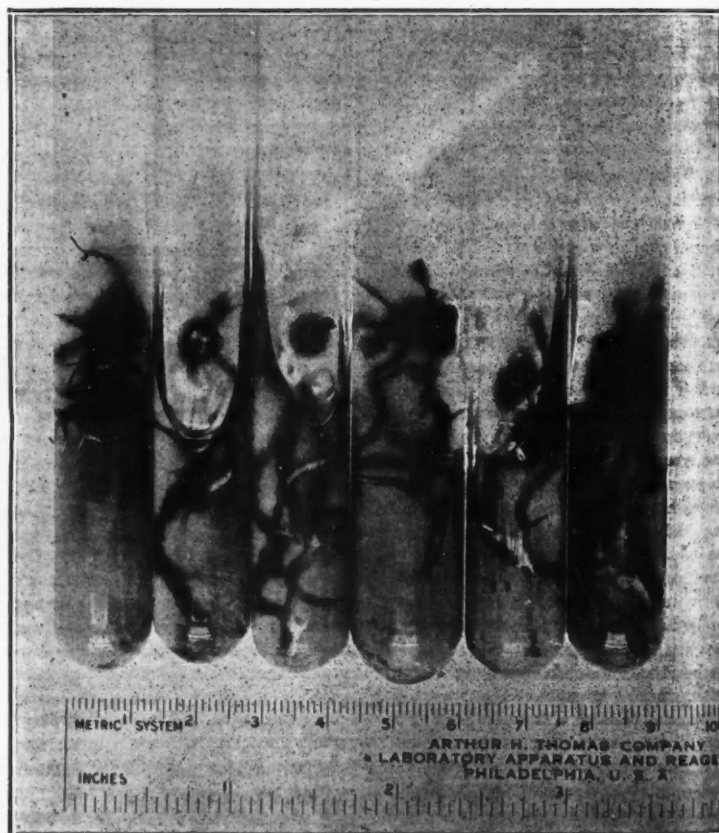


Fig. 6—A series of 10-day-old cultures of the *Clitocybe* mushroom root rot fungus on nutrient medium in test tubes, showing the abundant development of branching rhizomorphs characteristic of this fungus.



bases of the trees aid materially in the reconnaissance, will result in finding a large number of trees attacked by mushroom root rot.

To date, approximately 150 citrus trees in Polk and Brevard counties have been found to be attacked by the *Clitocybe* root rot fungus. The attacked trees, which range from 9 to 20 years in age, were on rough lemon root stock and on well-drained sandy land in all cases. They comprise mostly grapefruit trees, with some orange and a few tangerine trees. These ranged from individual trees to more or less grouped trees, and even areas where a considerable number of trees were attacked.

The remarkable extent to which this trouble has been found to occur on the strength of preliminary investigations in a few fairly young groves where the trees appeared quite healthy above ground indicate that it is a problem for serious consideration. From the widespread distribution of the *Clitocybe* root rot fungus on a diverse array of woody plants throughout a large part of the state and the numerous records obtained of its occurrence on citrus trees in a few sections during 1930 and the early part of 1931, it is undoubtedly likely that this disease will eventually be found to be of fairly widespread and common occurrence on citrus trees, at least throughout the central portion of the peninsula where the rough lemon rootstock is universally used and oak trees are prevalent.

It is quite evident that this mushroom rot of citrus trees is no new trouble but that it simply has not been distinguished heretofore from foot rot which it closely resembles in the behavior of the attacked trees. The failure in the past to distinguish *Clitocybe* mushroom root rot from foot rot of citrus trees may well be the reason why some growers consider the rough lemon rootstock to be quite subject to foot rot. The publicity given to this destructive new disease of citrus trees should not alarm growers unduly since its identification probably does not portend any added loss of citrus trees to that already experienced and attributed to foot rot. The recognition and understanding of this new disease merely enables us to properly diagnose the cause of a part of our root troubles of citrus trees rather than to continue to assign them all arbitrarily to foot rot for lack of better knowledge.

#### Other Plants Attacked

In addition to citrus trees, *Clitocybe* mushroom root rot has been

found to attack a great variety of fruit, shade and ornamental trees, hedge and other ornamental shrubs in Florida. Among these may be mentioned grapevines, sand pear, common guava, Cattley guava, peach, banana, apple, apricot, loquat, avocado, Surinam cherry, roses, Java plum (*Syzygium cumini*), Canary Island date palm (*Phoenix canariensis*), tung-oil (*Aleurites fordii*), arbor-vitae (*Thuja occidentalis*), orien-

tidly from one attacked tree to another, especially when the trees are closely planted as in windbreaks, but plants set out to replace the dead trees that have been removed become infected and die at a very early age. The heavy mortality caused by this root rot fungus in Australian pine plantings is already causing considerable concern upon the part of developers of subdivisions, garden clubs, and individual planters. The



Fig. 7—Grapefruit tree treated for *Clitocybe* mushroom root rot, showing how dead roots have been removed and bark lesions cut out on the lateral roots and on one side of the tap root.

tal arbor-vitae (*Thuja orientalis*), eucalyptus (*Eucalyptus robusta*), Australian pine (*Casuarina equisetifolia*), hardy Australian pine (*Casuarina lepidophloia*), oleander (*Nerium oleander*), hibiscus (*Hibiscus rosa-sinensis*), Turk's-cap hibiscus (*Malvaviscus arboreus*), poinsettia (*Euphorbia pucherrima*), sand pine (*Pinus clausa*), castor bean (*Ricinus communis*), flame - of - the - woods (*Izora incarnate*), croton (*Croton striata*), acalypha (*Acalypha marginata*), laurel cherry (*Laurocerasus caroliniana*), Chinese tallow tree (*Sapium sebiferum*), rose apple (*Eugenia jambos*), royal poinciana (*Delonix regia*), southern red cedar (*Juniperus barbadensis*), dogwood (*Cornus florida*), turkey oak (*Quercus catesbaei*), viburnum (*Viburnum odoratissimum*), privet (*Legusturm sp.*), Cotoneaster sp., and jasmine (identity unknown).

*Clitocybe* root rot constitutes a most important source of loss in the numerous Australian pine plantings in many parts of central and southern Florida, this widely planted tree being especially susceptible. Not only does this root rot fungus spread rap-

idly from one attacked tree to another, especially when the trees are closely planted as in windbreaks, but plants set out to replace the dead trees that have been removed become infected and die at a very early age. The heavy mortality caused by this root rot fungus in Australian pine plantings is already causing considerable concern upon the part of developers of subdivisions, garden clubs, and individual planters. The

The question is often raised as to whether or not we can find some trees and shrubs to plant that will be resistant to attack by the *Clitocybe* root rot fungus. Judging from the omnivorous nature of this fungus as evidenced by the wide variety of plants attacked, the prospect of finding useful plants that are resistant does not appear to be very promising at present.

#### Symptoms on Citrus Trees

The symptoms exhibited by citrus trees attacked by the *Clitocybe* mushroom root rot vary greatly with age and progress of the disease. In the 70 attacked trees treated at Lake Alfred, with the exception of one tree which required heading back, the disease had not attained sufficient headway to cause a decline of the tops and these trees appeared as

(Continued on page 38.)

# The Citrus Industry

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## IMPORTANT MOVES BY CLEARING HOUSE

Two important developments in the activities of the Florida Citrus Growers Clearing House Association have been consummated during the past month. The first of these was the election of four new directors, and the second the inauguration of a campaign of education to acquaint Florida interests with the magnitude and importance of the citrus industry to the state as a whole.

The election of four new directors became necessary by reason of the resignation of four former directors due to the withdrawal of the Florida Citrus Exchange from the Clearing House.

The new directors are: J. H. Letton, Valrico, District No. 2; W. J. Howey, Howey-in-the-Hills, District No. 3; E. H. Williams, Crescent City, District No. 4; and Senator M. O. Overstreet, Orlando, District No. 5. Probably no four men of greater consequence in the citrus industry of Florida could have been named, and in cooperation with the other directors: J. C. Chase, R. B. Woolfolk, O. F. Gardner, L. P. Kirkland, Dr. E. C. Aurin, A. M. Tilden and A. R. Trafford, they constitute a board of directors comprising in its membership some of the most able and most consequential men in the industry.

In the selection of Karl Lehmann, long secretary of the Orange County Chamber of Commerce and one of the best known men in Florida, as leader of the publicity and educational campaign, the Clearing House chose wisely and well. No better choice could possibly have been made. With such a board of directors and such a leader in the educational work of the organization, the interests of the Clearing House will be ably, efficiently and intelligently administered.

## CANNED CITRUS FRUITS

The activities of the Florida Citrus Exchange in promoting and co-ordinating the canning and marketing of citrus fruits is to be commended.

The experience of last year, when over-production, disorganization and, in some instances, unsatisfactory product, brought disappointment to both growers and canners, demonstrated the need of radical change in the methods to be pursued if the canning industry is to provide the satisfactory outlet which Floridians generally anticipated at the opening of last year's canning season.

Recognizing the need for changed methods, both in handling and in marketing, the Exchange has set itself the task of bringing about the needed reformation. The task is not an easy one, and this the Exchange itself realizes, but that organization has set about the work with an energy which deserves, and which all in the industry hope will be crowned with success.

## THE GREEN FRUIT LAW

Florida's new "green fruit" law may not be all that either growers or shippers might wish. No, state, so far as we have observed, has yet succeeded in finding a satisfactory solution of this vexing and costly problem. But insofar as it lies in the power of the enforcing officers, it appears that the new law is to be enforced without fear or favor. Secretary of Agriculture Mayo emphatically states that all violations of the law as it now stands will be vigorously and promptly prosecuted.

This is as it should be. Florida, in common with other citrus producing states, has too long suffered the ill effects of the marketing of green and unfit fruit. Insofar as the present law tends to remedy this evil, it should be enforced to the letter and every violation should be speedily punished. Let us show the world that Florida can and will ship nothing but ripe and edible fruit. So far this season, there has been a commendable spirit of co-operation on the part of growers and shippers. Let us hope this spirit may continue throughout the inspection period.

## A NEW MEMBER OF THE FAMILY

The Associated Publications Corporation, publisher of The Citrus Industry and The Fish and Oyster Reporter and owner of the Bartow Printing Company, takes pleasure and a certain degree of pride in adding to its family the newly established Polk County Democrat, which it presents to the readers of Polk county in the belief that it will prove as acceptable in its field as The Citrus Industry and The Fish and Oyster Reporter have in the fields they occupy.

The management and editorship of the latest member of the Associated Publications Corporation family is in the hands of Mr. S. Lloyd Frisbie, for many years connected with the Tampa Daily Tribune, and who since its inception has held the position of Secretary-Treasurer of the Associated Publications Corp.

In adding this new publication to its list of periodicals, the Associated Publications Corporation believes that it is strengthening itself and is confident that it has delegated the management and editorship of The Polk County Democrat to worthy hands.

# Recent Results of Fertilizer Experiments With Citrus

R. W. Ruprecht, Chemist, Florida Agricultural Experiment Station, at Farmers' and Fruit Growers' Week.

The following is a rather brief summary of the results we have obtained in some of our fertilizer experiments up to this time. This is not a final report by any means and is simply given to keep the growers acquainted with the experiments and the results we are getting.

## Potash Sources

Until this year we have had two experiments with citrus where we were comparing three sources of potash, one at Vero Beach on the East Coast, and the second at our Citrus Experiment Station at Lake Alfred. Unfortunately, the one at Vero Beach had to be discontinued this year as the cooperator was unwilling to continue it. The sources of potash compared are the high grade sulfate of potash containing 48% — 49% potash (K<sub>2</sub>O), the high grade muriate of potash containing 50% potash (K<sub>2</sub>O), and the low grade sulfate of potash, also known as potash magnesium sulfate containing 25% of potash (K<sub>2</sub>O). This last source also contains magnesium sulfate about 34%. These three sources were tried separately and in combination, thus at Vero we had seven plots as follows:

Plot 1, H. G. sulfate of potash, three applications.

Plot 2, muriate of potash, three applications.

Plot 3, potash—magnesium—sulfate, three applications.

Plot 4, muriate of potash, February, and sulfate June and November.

Plot 5, muriate of potash, February, and pot. mag. sulfate June and November.

Plot 6, muriate of potash, February, and pot. mag. sulfate June and sulfate November.

Plot 7, muriate of potash, February and June, Pot. Mag. sulfate November.

Each plot receives the same amount and source of nitrogen and phosphoric acid.

This experiment was begun in October, 1923. Each plot contains Dancy tangerines, pineapple and Valencia oranges and Marsh seedless grapefruit. Growth measurements were taken for several years but no striking differences due to the different potash sources were found. The first crop was harvested in 1925

and was rather light.

In studying the yield data of the various varieties we note some peculiar differences. In the case of the pineapple orange, Table 1, you will note in comparing the first three plots that in five out of the six years the muriate plot has had the highest yields. True, in only one year, 1929, has the difference in yield been large enough to be significant. In all, the yields of the first three plots have been about equal.

Let us now turn to the last four plots where muriate and the two sulfates were used. Here we find that in four years the plots where muriate was used twice a year had a higher yield than when it was used once.

Let us now turn to the Valencia oranges, Table 2. Here we find a different result. In the five years for which we have a record the sulfate has given the larger yields than the muriate, each year and with two exceptions larger than the low grade sulfate. The differences are also somewhat greater than in the case of the pineapple oranges. Considering the last four plots where muriate was used with the two sulfates, we find a similar tendency, namely, a falling off in yield where more muriate is used, altho the differences are not as great.

Let us now look at the grapefruit yields, Table 3. Here we find a condition similar to that found with the Valencias, larger yields with the high grade sulfate. Studying the yields from the last four plots we find that there is no consistent difference between where muriate is used once a year or twice a year. Except for 1930 the yields from these plots are lower than Plot No. 1, the sulfate plot. This past season we obtained about as good a yield from Plots 5 and 6 as from No. 1.

No results are given for the tangerines for the following reasons: First, there were only six tangerine trees in each plot and secondly, the tangerine trees bordered a public highway and a good proportion of the crop was lost every year, especially from Plot 1 which was nearest the gate.

Taking the three tables together what should our conclusions be? Can we say that different varieties of or-

anges respond differently to the same fertilizer despite the fact that they have the same root stock. If this is the case, our citrus fertilization is indeed complicated. It is hardly fair to condemn the muriate on the results of this one experiment, especially in view of the fact that on other crops where a prejudice against muriate had existed, this source is proving to be as good, and in some cases better than the high grade sulfate. It is to be regretted that this experiment had to be discontinued at this time. This is one of the weak points in conducting experiments on a cooperative basis instead of on our own property. Our grove at Lake Alfred duplicating these experiments has just reached the bearing age so no conclusions can yet be drawn.

Next we will take up another potash experiment. This time instead of comparing sources we are comparing the amounts of potash. This experiment is located at our Citrus Experiment Station at Lake Alfred, and probably many of you have seen it. This experiment was begun in 1921 with trees about 5 years old. All of the plots receive the same amount and kind of phosphoric acid and nitrogen. The nitrogen being derived from nitrate of soda and tankage, the phosphoric acid from Superphosphate. Plots 1 and 3 receive 3% potash in the fertilizer at each application. Plots 2 and 4—10% at each application, while Plot 5 receives 5% and Plot 6, 3% in the spring, 5% in the summer, and 10% in the fall. All of the potash is high grade sulfate. There has been a very noticeable difference in the appearance of these trees from time to time. The plots receiving the 10% potash have not had as dark green foliage as the balance of the plots. Many times the foliage on these trees had a bronze color.

In studying the yield data of the oranges, Table 4, we find there is no very consistent differences. During the nine years Plots 5 and 6 have most often been the heaviest yielders. The 10% plots have only had the highest yield once, and second highest once.

Turning to the grapefruit yields, Table 5, we find no outstanding difference. (Continued on page 27)



# IMPRESSIONS

By the Impressionist

She was an earnest and sincere little thing, albeit a bit gushy and given to reading signs. "My little niece is so fond of animals," she explained. "We are staying at Orlando. We have been to the Kissimmee zoo to see the animals, and they are just too cute. We have been to the Sanford zoo, and it is just wonderfully interesting. Now we are looking for an opportunity to go to see the Ape at Howey-in-the-Hills."

A Sanford drug store advertises to sell: "anything from a mild laxative to a clap of thunder." Hey, Billy Leffler, please pass around the lightning rods.

John J. Swearingen of Bartow, the sudden victim of an automobile crash. The state senator from Polk was one of the old and prominent figures in things citrus in that citrus empire, as well as one of the state's leading lawyers.

R. J. Taylor, vice-president of the Federal Land Bank at Columbia, unafraid to face facts, recently stated that the Federal Land Bank now owns outright some 1,900 farms. And thus Uncle Sam gets into the farming business via the mortgage route. However, Mr. Taylor indicated they were having fair luck in slowly selling off some of the farms upon which foreclosures had been made.

And now from up at Howey-in-the-Hills comes the news that the third and last vacuum tank in which oranges had been stored has gone bad. This terminates the initial experiment; and something more than eight carloads of fruit have been sacrificed to finding out that this, for the present at least, is not the long dreamed-of method of storing citrus for which some have been seeking.

The longer we have contact with the handling and selling of citrus the more strongly are we impressed that there is no practical method of storing citrus; that our selling job to be done best is to get our fruit from tree to consumer in the speediest way and in the freshest possible condition. Canned fruit is, of course, excepted. This past Spring's experience with cold storage, and the enor-

mous financial losses entailed, only confirms our previous conviction.

In the case of the Howey experiment, however, we give credit freely to W. J. Howey and his associates for proclaiming in advance that this was purely an experimental operation. By experimenting we progress; and no thinking person can object to well calculated experiments provided they are labeled as such. Too many times in the past has the Florida citrus business suffered through the failure of what actually were experiments, though foisted upon the growers as already proven procedures.

The limited storage of Florida Valencias in New York for a number of years has misled a number of persons. Each season, along in May, there has come a flurry in Valencia prices. That's the hotel brokers accumulating them for cold storage. All Summer long, and into the Fall, the elite New York hotel dining rooms serve Florida Valencias, delightfully fresh and tasteful, but—Here is how it comes about: That limited amount of fruit is stored in carefully selected cold storage space, with full humidity control and all that sort of thing; and only a very small portion of the so-called available cold storage space in the country comes up to these requirements. Then during the warm weather these Valencias are broken out of storage at night, to make hasty trips across town after midnight and then to be plumped directly into the cold storage rooms of the receiving hotels. From these they come out into the hotel kitchens a single box at the time, to be handled quickly, and any remainder goes back under refrigeration speedily. The Valencia orange which comes to your plate is only a very few minutes out of cold storage. That is a specialized operation; and cannot very well be enlarged over a broad field.

If the wholesale and retail fruit trade in general is very suspicious of cold-storage citrus, it is because that trade has found that cold-stored oranges and grapefruit have a tendency to melt down like wax

when later exposed to ordinary room temperatures.

An enthusiastic admirer writes likening Impressions to the famous five-foot shelf of books which Dr. Elliot recommended. He implies that anyone reading Impressions consistently is bound to be well educated in citrus. Just as we were swelling around and mentally wallowing in this bit of flattery, we received word from Messrs. E. D. Dow and J. R. Crenshaw, the heroes of the snake stories in the August issues. To be brief about the thing, Messrs. Dow and Crenshaw are in substantial disagreement with this other gentleman. Life is funny like that.

Odd thoughts at odd moments: The memory of lying flat upon one's belly, as a little fellow, upon oranges piled high on the upper story of an old time packing house, feeding oranges down one of the old gutter-like sizers until there was a sufficient space cleared for a grown man to stand in. . . . palmetto leaf-stems in great number, soaking in a spot in the river, softening up to be split for orange-box hoops . . . orange polishers, utilizing oil soaked sawdust, and doing a pretty good, if rather slow, job at that . . . rows of brass stencils in the packing house to stencil shipping directions upon the head of each box . . . the smell of stencil ink . . . the changing of freight car trucks and wheels at Sanford, from narrow-gauge to broad-gauge, or vice versa . . . talk around the house of a growers' meeting, discussing "over-production" when the crop threatened to approach the two-million-box mark . . . Spice Mandarins, that nowadays folks call Cleopatras . . . the old Shaddock tree in the northeast corner of the front yard, and tourists exclaiming over its fruit . . . a big team trying to run away from the odor of the load of "blood and bone" they were hitched to . . . the panels of home-made portable fence used in "cow-penning" sections of the old grove . . . traveling solicitors for northern commission houses, who weren't above buying a bottle of sarsaparilla soda pop for a thirsty young fellow.

(Continued on page 26)

# BLUE GOOSE NEWS

Monthly News of American Fruit Growers Inc.



Edited by The Growers Service Department

## CRUTCHFIELD IS HEARD AGAINST RAIL RATE RAISE

According to writers who recorded the event, the recent testimony before the Interstate Commerce Commission of J. S. Crutchfield, in opposition to the proposed increase of fifteen per cent in railroad freight rates, carried unusual weight and significance. Testifying not only in capacity as president of the American Fruit Growers Inc., the Union Fruit Auction Co., Pittsburgh and the William Penn Trust Co. of that city, he was likewise testifying as a director, and as chairman of the agricultural committee, of the United States Chamber of Commerce. His opposition to the proposed increases was both outspoken and well grounded. In full his testimony would fill numerous printed pages. Only the high lights, so to speak, can be covered in this account.

"The relatively high cost of freight transportation during depressed times forces an undue portion of the tonnage to be huckstered and distributed direct from producer to consumer, eliminating the unbearable expense of railroad transportation," he told the Commission in substantiation of his assertion that the railroads had themselves brought on many of their difficulties. He cited Georgia peaches selling this summer at 50 cents a bushel after being trucked to Florida points to which the railroad freight was from 50 to 70 cents per bushel.

It was his opinion that during abnormally prosperous times since the war the rail lines had enjoyed sufficient traffic and profits that they ignored the fact they were steadily losing increasing volumes of traffic and by their high level of rates unduly stimulating other forms of transportation. "Transportation is a commodity and has its market price or value; and, in my opinion, the railroads have not recognized the true market value of their services," he

"The size of the coming season's Florida citrus crop is a matter of great interest at this time. From our own men and from any and all others with whom I have had contact recently I have tried to obtain their best estimate of crop conditions in their respective sections, and over the state as a whole. Averaging these estimates and opinions I find that it is the consensus of the opinion that this coming crop is no more than seventy per cent of last season's yield. This information I pass along to our growers for whatever it may be worth."—R. B. Woolfolk.

## MANAGERS HEAR THAT OUTLOOK IS BRIGHTER

"I am right now more optimistic concerning the outlook for the satisfactory marketing of the coming season's Florida citrus crop than I have been at any time during the past four months." That was the statement of R. B. Woolfolk, senior vice-president of the American Fruit Growers Inc. in addressing a statewide meeting in Orlando on September 2 of executives and packing house managers of the organization.

Continuing, Mr. Woolfolk said he had found conditions anything but satisfactory in an extended trip recently over the northern market centers; yet to him the situation seemed in considerable part to be psychological, and any small turn in events might be sufficient to start business upon an upward trend. He cited also the willingness of the markets to pay good prices for whatever was short, in contrast with the generally prevailing low prices for such foodstuffs as have been almost too plentiful. Iceberg lettuce and cauliflower, he said, were two such items, in which market shortages produced high levels of prices. With a slight shortage iceberg lettuce had been selling as high as nine dollars per crate when he was in New York recently, he said. These facts, together with other noticeable trends, and the relatively shorter citrus crop in sight in Florida are, he believes, a good basis for optimism.

C. N. Williams, citrus salesman, told of the extremely small sizes of California Valencia oranges being marketed and now upon the trees; and indicated belief that Florida oranges should meet with favorable market reception, without serious competition in the markets from the oncoming crop of California navels, until after Thanksgiving. Recently available figures, he said, materially reduced the remaining quantity of grapefruit to be shipped from Porto

## ON TRIPS TO MANY OF LARGE MARKET CENTERS

After returning to Orlando following the Apple Convention, because of pressure of business here, C. N. Williams, citrus salesman left again on September 3 for a further trip to contact certain larger market centers in advance of the beginning of the early portion of the crop movement.

Allen E. Wilson, assistant citrus salesman had left some days earlier on a trip which will carry him into many markets in various sections of the country not included in Mr. Williams itinerary.

Both are contacting prominent buyers and perfecting arrangements which will facilitate Florida citrus sales by the American Fruit Growers Inc. during the coming shipping season.

said in part.

"Orderly marketing of agricultural products at low prices its difficult  
(Continued on Page 2)

(Continued on Page 2)

## BLUE GOOSE NEWS

OF INTEREST to the citrus growers of Florida, each month, contained in four pages of paid advertising from the

**AMERICAN FRUIT GROWERS INC.**

Florida Division

Sixth Floor, State Bank Bldg.  
ORLANDO, FLORIDA



### TOO MUCH INTERFERENCE

Recognition is generally given for the outspokenness and straight thinking of the men who go to make the big livestock interests in certain of our western states. Not long since the Nebraska Stockgrowers Association adopted a rather outspoken resolution. That resolution has since been concurred in by the livestock growers associations of Wyoming, and Western South Dakota. It voices therefore the sentiments of the men upon whose investments and activities this country relies for a large portion of its meat supplies. Its language is as follows:

"WHEREAS, there exists today a serious depression in all lines of business and industry, and

"WHEREAS, the agricultural industry has been hit a little harder than most, and

"WHEREAS, the Government of the United States is continually creating more commissions and more boards,

"NOW THEREFORE BE IT RESOLVED, that the Nebraska Stockgrowers Association, in convention assembled, recommends, as a partial relief for this depression, less commissions, less boards and less government interference in business."

### MANAGERS HEAR

**OUTLOOK IS BRIGHTER**  
(Continued from Page 1)

Rico; and revised estimates from the Adv.

Texas area indicated that shipments from there will be only about one-half of the larger estimate earlier given out.

At luncheon the gathering was addressed by Karl Lehmann, who outlined the proposed campaign of education on behalf of the Florida Citrus Growers Clearing House Association, which he is now directing from Winter Haven, and of which he will have charge during its progress. His talk was enthusiastically received, and the full strength of the American Fruit Growers Inc. organization was pledged to him and his associates in their effort.

It was an all day meeting for which the American men gathered, being held in one of the private assembly rooms of the Angebilt hotel; and interspersed by an excellent luncheon served in one of the private dining rooms during the noon intermission.

A considerable part of the day was devoted to discussion of organization matters, and of plans for the improvement and increased efficiency of packing house and sales operations. All reports indicated a continuing enlargement in Florida of the business and service of the American Fruit Growers Inc. Notwithstanding the fact that the past shipping season was the largest in the history of the organization's Florida activities, a review of prospects for the coming season promises that the American Fruit Growers Inc. will handle an even larger percentage of the state's citrus crop than in any year heretofore.

Among those present and participating were: E. G. Youngblood, Lake Jem; D. A. Field, Ocoee; J. E. Powell, Avon Park; J. W. Parker, Walsingham; Ervin Springstead, Carl B. Bates, Palmetto; L. F. Chapman, Deland; S. D. Gaines, N. B. Ryall, Wabasso; Paul W. Rogers, Maitland; R. J. Flynn, Odessa; H. S. Parkinson, Alva; F. B. Smith, Arcadia; T. S. Kirby, Fort Pierce; Walter J. Merrill, Lakeland; F. J. Bohde, G. M. Cranston, Alturas; B. W. Flood, B. B. Scarborough, West Frostproof; Frank P. Beatty, Cocoa; Clay Binnion, Alex Warren Jr., Winter Haven; J. H. Letton, Valrico; O. F. May, Mascotte; N. H. Harper, New Smyrna; A. G. Warn, Haines City; A. Gunn, J. T. Helms Jr., Valrico; D. B. Rhea, Haines City; N. F. Enns, Ozone; R. B. Woolfolk, C. N. Williams, C. R. Pilkington, G. D. Wing, C. W. Rodgers, J. R. Crenshaw, S. Z. White, C. J. King, Orlando.

### CRUTCHFIELD IS HEARD AGAINST RAIL RATE RAISE (Continued from Page 1)

enough, but when demoralization is produced because of the attempt of the railroads with Government sanction to still further advance transportation costs a condition approaching panic results. . . In my opinion just such unsound principles emanating from high sources have destroyed confidence and created an unnecessarily acute general business depression," was another of his statements.

Further he said: "The worst thing that could happen to the railroads would be to have this advance granted upon agricultural products or raw materials similarly suffering from a long period of depression." And then: "Adverse times, such as these, furnish the railroads the necessary urge and opportunity for many improvements in method and in the adaption of their facilities and service to meet the situation and the demands of the public."

"Agriculture has not recovered from the disaster it met when in 1920 the railroads received a 35 per cent to 40 per cent increase in freight rates overnight. . . Agriculture has had eleven years of depression, whereas the railroads since 1920 until last year have been having a remarkable comeback in earnings and general prosperity. A comparatively brief period of railroad depression, as compared with the agricultural depression, causes the carriers to seek the line of least resistance, an increase in freight rates, without any evidence or proof from their traffic officials that an advance in freight rates will increase the net revenue," he said in another place.

"American business genius," he concluded, "is amply capable of . . . working out a solution. . . No man or group of men in this country is justified in stating there is going to be any serious trouble, financial or otherwise, because of business and industry, including the railroads and agriculture, taking whatever necessary steps to conform to the existing economic price levels until we can build a higher economic level upon which to do business. . . All industries. . . are supposed to be able to stand a year or two of depression. In fact, it requires a year or two of depression occasionally for the discipline of hard times to correct fundamental faults of organization, management, excessive costs, operating policies, public policies and laws."



# ROGERS & COMPANY, INC.

MORTGAGE LOANS

INVESTMENT SECURITIES

NORTH BIRMINGHAM, ALA.

July 22, 1931

American Fruit Growers, Inc.  
Haines City, Fla.

Attention A. G. Warn, Mgr.

Dear Sir:

I have just returned from a visit to my grove in your vicinity of which last years fruit production was handled by you in a manner very satisfactory to me.

I appreciate the attention you gave my grove during the season and feel that you handled it much better being on the ground, than I could have done from my place of business in Birmingham, Ala., and this is to authorize you to handle the present crop of fruit which is very promising in quantity and I hope you will be able to procure for me good prices for it.

Yours very truly,

(Signed)

C. B. Rogers

## AFG MEETS ACID TEST IN PEACH HANDLINGS

The conclusion of the Georgia and North Carolina peach deals recently served to establish clearly to the growers there the advantages of the selling service of the American Fruit Growers Inc.

As is well known in produce circles both these operations were attended by extreme difficulties for all operators. Market conditions, the lateness of the crop, and other things combined to make unusual complications. In the face of these, many whose sales depended upon a comparatively few market outlets met with numerous actually disastrous sales.

The comparative record of the American Fruit Growers Inc. stands out as one of the salient features in the selling of peaches from these producing districts this season. After review of these operations Manager W. M. Scott, Allen E. Wilson, Stacy Z. White, William Kolbe and others engaged at the Macon, Georgia and Candor, North Carolina, offices during the summer have been receiving the sincere congratulations of their associates since their return to the Orlando offices at the conclusion of their summer's

work; and likewise have been commended highly by the executives of the organization for their successful efforts. Their untiring work, and intelligent handling of the local situations, plus the widespread selling force of this organization put the American Fruit Growers Inc. to the front during periods which constituted truly acid tests of selling efficiency.

## "LITTLE BLUE GOOSE" GETS BIG JAPANESE APPROVAL

Those magic words "Blue Goose" got into public print all over the world on August 18. Not in any connection with the famous Blue Goose trademark this time, but as applied to Mrs. Anne Lindbergh, who with her famous aviator husband had just arrived at Petropavlovsk on the Kamchatka peninsula.

Part of the text of the Associated Press despatch sent from Tokio on August 17, and printed all over this and in other countries, read as follows:

"Col. Charles A. Lindbergh and his wife, Anne, dubbed the Little Blue Goose by the Eskimo women at Aklavik because of her flying abilities had hoped to fly the . . ."

Thus more publicity for the Blue Goose, the "lucky bird" of the Eskimos and northern Indians, through the charm and personality of Mrs. Lindbergh. And the Blue Goose trademark, coincidence though it may be, is at least spelled the same. Thus it basks in reflected glory though none connected with the AFG organization can claim credit for the occurrence.

## BLUE GOOSE TO FRONT IN BIG ATLANTA EVENT

Concerning the performance of Harry E. Johnson, the well known Haines City citrus grower who does his trap-shooting with a big Blue Goose on his white sweater, the Sportsmen's Review, prominent national weekly, in recounting the recent Southern Championship shoot held at the Capitol Gun Club, Atlanta, says:

"Harry Johnson of Blue Goose orange fame, and one of the South's finest shots, was at the top all the time. He broke 195 the first day, 196 in the championship, and 94 from 23 yards in the handicap." Thus Mr. Johnson added another notable performance to his record, which is away up among the top liners of Class A trapshooters.

Adv.

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## ONE HAZARD WHICH IS ENTIRELY ELIMINATED

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Those growers who are served by packing houses owned by the American Fruit Growers Inc. have none of their own money tied up in packing facilities. They have all the advantages of modern houses and the last word in equipment to prepare their fruit for the market, and they do not have to figure interest upon their investment, insurance, maintenance, repairs, replacements, depreciation, obsolescence, nor the risk of entire loss of the packing house investment through some possible calamity.

With no portion of their funds frozen in the form of such investments they are free to make full use of the net returns from their crops in the development of

their own properties. For them one hazard of the fruit business is entirely eliminated.

Yet the American Fruit Growers Inc. does not demand that the fruit it sells be packed in its own packing houses. On the contrary, it has no interest whatever in many grower-owned, grower-controlled packing houses the fruit from which it sells in the markets.

This organization is first, last and always a selling organization. The growers it serves have free and unrestricted choice of the character of ownership of the house in which their fruit is to be packed.

### American Fruit Growers Inc.

Florida Division  
Orlando, Florida

# Pumpkin Bug Control

By J. R. Watson at Farmers and Fruit Growers Week

I suppose you all know what we mean by pumpkin bug. Although there is some lack of uniformity in the use of the term, usually we mean by pumpkin bug the "Southern Green Stink Bug"—that big green stink bug we in Florida are all too familiar with. I will not make any effort to show you any specimens this morning, but we will, however, have some on display tomorrow at the laboratory. Some people use the word "pumpkin bug" to include practically all stink bugs. There are three or four brown and gray ones that usually attack citrus, as well as the green one.

In order that we may understand better the control of the pumpkin bug, we had better first consider its life history. Like all insects, they come from eggs which are laid in bunches on the underside of the leaves by the adult females. These eggs are hardly noticed as you go through the grove. If you will lie down on your back under a cover crop you can easily see them on the underside of the leaves. Sometimes these pumpkin bugs are highly parasited.

These eggs on the undersides of leaves hatch out in three or four days in the summer time. It requires a little longer time in the fall and spring. The young bugs that hatch out have a very different appearance from the old pumpkin bug; they are bluish in color with yellow markings. They require about a month for their complete development. They gradually change to a lighter color until they emerge as adults with wings. In the neighborhood of Gainesville we find very few young from the latter part of November until the first of April. During the winter about half of the adults hibernate under logs, bark, etc. These are pink rather than white. The other half do not hibernate, but are found on truck crops, such as petsai, collards, turnips, lettuce, radishes, etc. In the spring when the big headed thistles come up, they are a favorite host plant of the pumpkin bugs. Later beans, tomatoes, potatoes, etc., are attacked. Along in June and July when the cowpeas and the beggarweed get large enough they migrate to those crops. They raise about half a dozen generations during the summer, spring, and fall, and the last generation eggs are mostly laid in early

September. This is an important matter to consider in the management of the cover crop. Of course, these generations more or less overlap, and you will find them all sizes at this time of the year. But on the whole the majority of them will be at a certain stage at a certain time.

I have outlined the seasonal history to emphasize this fact, **DON'T HAVE A CONTINUAL FOOD CROP IN THE GROVE.** I don't need to describe what the bugs do to citrus, of course. They puncture the fruit. Of course, such fruit will not carry to market as these punctures form avenues of entry for fungus diseases. Also the oranges will dry out. The different varieties are attacked in direct proportion to the thinness of the rind. Tangerines then satsumas first, including pineapples and valencias, and last of all grapefruit, which are not ordinarily much attacked by pumpkin bugs. The stink bugs do not care for the fruit until it approaches maturity, and are seldom ever found on green fruit. In the summer time they are raised in citrus groves entirely on the cover crop. Of the cover crops ordinarily used in citrus groves, cowpeas are their first choice, followed by beggarweed, velvet beans, *Crotalaria striata*, and *Crotalaria spectabilis*. We have heard a great deal about the *Crotalaria*s and pumpkin bugs for the last few years. The *Crotalaria*s are not any more apt to raise pump-

kin bugs than any of our common covercrops—not as much in fact—but there is this difference. The *Crotalaria*s will bring pumpkin bugs up through the fall until the citrus is attractive. On the other hand the cowpeas and beggarweed die down in the fall and are not so attractive. The bugs don't care for *Crotalaria* much until it begins to form pods. A few pumpkin bugs are there on the leaves and tender stems, but very few on *Crotalaria* until it begins to form pods. That is the reason why we find differences in the different species of *Crotalaria*.

*Crotalaria striata* will begin to bloom sometime in May or June, and at this time of the year you will find considerable bloom on *striata*, and pumpkin bugs will be there too. *Spectabilis* is different, it does not bloom until late in the season, ordinarily about September (we used to call it *serica* by the way). When it does bloom it sets a heavy bloom and has an immense number of pods, and the pods ripen shortly. Altogether the season during which *spectabilis* is attractive to the bugs is very brief. Most of the cover crops are attractive over a much longer time. For that reason, of all cover crops that we have in a citrus grove, a pure strain of *spectabilis* is the safest.

In such a grove at Marianna, Mr. Bratley and I spent half a day last fall and we found half a dozen pump-

(Continued on page 29)



Write, wire or phone us at our expense and a representative will call on you.



# CITRUS COMMENTS

—BY—

Charles D. Kime, Orlando, Florida

This department is devoted to furthering horticultural interests of Florida. Letters of inquiry, discussion or criticism will be welcomed

## Interpreting Fertilizer Tests By Growers (continued)

Running fertilizer plots can be both interesting and profitable when done in the right way. In work of this kind negative information is just as valuable as positive results. That is if the results are not what we want or are disappointing, they may be of even greater value than if the reverse were the case. So if we decide when beginning such work to see what is actually there, and not what we desire to find, we may read our records as written out for us by the grove itself much nearer right than is occasionally done by users of new materials. It often happens that materials are discarded or that we become prejudiced against them because of lack of proper use. If we use a good material wrongly and get poor results, we have made a serious mistake. Yet, I believe that mistake is a very common one.

The size block is a matter of convenience provided always it contains a sufficient number of trees to give us actual results from our works. Three by three rows each way with a buffer row between each plot and its neighbor is the smallest size plot that would permit a minimum of overlapping between the trees in adjacent blocks. This size plot gives a 4x4 area of 16 trees. A single tree row is hardly desirable as it will not prevent overlapping between treatments in adjacent rows. The length of a single row would be immaterial, as the same overlapping effect would prevail thruout its length. Side hill slopes are less desirable than flat areas as there would be considerable lateral movement of fertilizer materials in solution down the slope. The less water movement the more certain we can be that our results are due to the work we have been doing and not partly due to fertilizer applied elsewhere in the grove and carried into the block in the soil water. If we are already sure that the fertilizer we want to try is a safe material, we can plan a much larger block or take in the whole

grove and work it into the fertilizer set-up. One must be sure of his results before taking such a serious risk.

When choosing blocks in which to test out materials the age of the trees is of as much importance as the location of the block. Younger trees must be grown to larger sizes at the same time that they are bearing fruit. Old trees must be kept in good fruiting condition, and therefore growth is of secondary importance. Fruit and quality is of the greatest importance in any case, so whether we choose a young bearing block or an old block, we must have the fruit foremost in our minds and not the growth alone. The variety of fruit is of importance in our record of results as there is a distinct difference in behavior between Parson Browns, Pineapples, Valencias, Tangerines, and Grapefruits. There seems to be less difference in our rootstocks than there is between varieties to which the rootstock is budded.

The steps to this point in our selection would be to take not less than 16 trees in a square of the same variety of fruit. Pick a location that is reasonably flat or that will not be greatly influenced by water seepage from above it. This means that the upper side of slope is a good location. Select bearing trees, the older the better, as such trees give us more valuable fruit quality results.

Having gotten all set for a demonstration, a start can be made. First, tag the block very plainly or sooner or later doubling of a fertilizer treatment will occur and a part of our results be cancelled thereby. Second, apply the material or materials selected, whether mixtures, straight goods or liquids in an even uniform manner thruout the block, covering only one-half of the outside 4th row which acts as a buffer row, but beginning close to the trunks of all trees on all of the rows and not at the outside edge of the branches. In this way the outside row is the dividing line and not an imaginary line down the center of a middle, which last cannot be kept definitely when

spreading fertilizer, and will actually allow for more serious overlapping of fertilizer effects than the former. Overlapping is always serious in small blocks, but of little importance where blocks are of some size.

There are two records in any grove test which must be kept in some detail. The first concerns the test block itself and the second comparison of the test block with some other block or part of the grove. Such records are necessary to pin down our results. For example, if block results are not good, the general grove results may not be good; also such as a generally light crop or poor fruit quality. It may be a poor growth season and all blocks may have very poor new growth. If the balance of the grove has poor growth also, a material used for that purpose should not be condemned. The comparative record therefore gives us a check on what might be termed outside conditions.

The manner of use of the material is important as it will affect fruit quality in some way. It must therefore be lined up for use at the proper season of the year for the most favorable effect; i. e. an organic applied in the fall often has no availability whatever for months and may lie practically unaltered all winter. Tree starvation is the consequence. A chemical applied in the summer may become quickly available during summer weather and over-forcing result. The material may delay maturity of the fruit. It may not combine properly or readily with other materials even when otherwise possessing excellent properties. All of these points are of importance and have been gradually worked out during the past through use and experience for these fertilizing elements now in use.

Whatever set-up is worked out or started, it must always include soil acidity tests. This pH reaction is of the greatest importance. It should be recorded regularly for each foot of the soil feeding area and taken at least twice each year. Briefly, its greatest importance lies in keeping  
(Continued on page 34)

# RECENT RESULTS OF FERTILIZER EXPERIMENTS WITH CITRUS

(Continued from page 11)

ferences in yields. Even the 9 year average shows no marked difference. Certainly we cannot say that the 10% plots were superior. From the general appearance we could find no marked difference in the quality of the fruit either oranges or grapefruit from the different plots. The packing house manager, however, stated that he could pick out the grapefruit from the 3% plots as they were of poorer quality than the balance of the fruit. We made some cold storage tests but the results were rather inconclusive. Tests should be made on the shipping quality of the fruit but this is rather an expensive experiment and we have never had sufficient funds to undertake it. I believe that we are safe in assuming from the above results that 5% of the potash three times a year or a total of 15-18% during the year will be sufficient for this type of soil, unless we can show that the higher amounts of potash improve the keeping quality or eating quality of the fruit.

Let us now take up the source of nitrogen experiment. This too, as many of you know is located at Lake Alfred at the Citrus Experiment Station. This experiment has also been running since 1921. The trees at that time were one year old. The ten acres are divided into ten plots. Plots 1-5 inclusive, contain tangerines, oranges and grapefruit, while Plots 6-10 inclusive contain only oranges. All of these plots received the same amount and source of potash. Plots 1-5 inclusive received steamed bone meal as a source of phosphoric acid. The sources of nitrogen varied as follows:

Plots 1 &amp; 6 — Nitrate of Soda.

Plots 2 &amp; 7 — Sulfate of Ammonia.

Plots 3 &amp; 8 — Dried Blood.

Plots 4 &amp; 9 — Combination of 1, 2, and 3.

Plots 5 —10 — Manure.

In the case of Plots 5 and 10 the source of nitrogen was changed in 1929 to  $\frac{1}{2}$  nitrate of soda and  $\frac{1}{2}$  sulfate of ammonia as the trees were in very poor condition. Incidentally I may say that seldom, if ever, have I seen trees recover so rapidly as did these trees. Today they are about the best in the experiment.

The yield of pineapple oranges are shown in Table 6. Considering the first five plots which have had superphosphate as a source of phosphoric acid, it is quite apparent that Plots 1 and 2 are producing the heaviest crops, with little difference between

## THE CITRUS INDUSTRY

3 and 4. Plot 5 as was mentioned above evidently was not getting enough nitrogen as the trees grew poorly, had a poor color and did not bear to amount to anything.

Turning now to Plots 6-10 which

meal or to the form of phosphoric acid or to the organic matter is hard to state. It is quite possible that had we grown a heavy cover crop of legumes in this grove the difference might have been greater. The rea-

Page twenty-seven

TABLE 1.—PINEAPPLE ORANGES, VERO. (Yields in pounds per tree.)

Plot	Treatment	1925	1926	1927	1928	1929	1930
1	H. G. Sulfate of Potash	9	156	98	147	169	346
2	H. G. Murate of Potash	12	131	106	155	233	349
3	L. G. Sulfate of Potash	3	119	91	140	178	311
4	Same as 2, 1 x, Same as 1, 2 x	12	164	94	146	154	325
5	Same as 2, 1 x, Same as 3, 2 x	11	148	88	137	140	300
6	Same as 2, 2 x, Same as 1, 1 x	25	133	167	158	214	301
7	Same as 2, 2 x, Same as 3, 1 x	21	127	109	119	190	276

TABLE 2.—VALENCIA ORANGES, VERO. (Yields in pounds per tree.)

Plot	Treatment	1925	1926	1927	1929	1930
1	H. G. Sulfate of Potash	24	61	152	293	267
2	H. G. Murate of Potash	8	55	135	234	217
3	L. G. Sulfate of Potash	12	61	246	190	184
4	Same as 2, 1 x, Same as 1, 2 x	11	60	124	233.9	225
5	Same as 2, 1 x, Same as 3, 2 x	16	47	122	206	201
6	Same as 2, 2 x, Same as 1, 7 x	15	58	109	233.6	196
7	Same as 2, 2 x, Same as 3, 1 x	9	40	92	210.3	164

TABLE 3.—TARDIFF ORANGES (Yields in pounds per tree.)

Potash	1922	1923	1924	1925	1926	1927	1928	1929	1930	Av. 9 yrs.
Plot 1. 3%	4	45	23	47	75	153	130	169	253	103
Plot 2. 10%	2.8	37	59	67	80	104	163	146	253	103
Plot 3. 3%	7	44	75	71	90	130	145	140	280	109
Plot 4. 10%	18	65	117	117	104	143	156	153	256	125
Plot 5. 5%	24	63	132	110	144	109	162	187	297	136
Plot 6. 3-5-10	* 44	77	128	97	172	126	171	225	284	147

\*3% Potash in spring, 5% in summer, 10% in fall.

TABLE 4.—DUNCAN GRAPEFRUIT (Yields in pounds per tree.)

Plot	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	Av.
Plot 1. 3%	231	171	394	120	772	126	277	228	833	350	
Plot 2. 10%	220	28	379	48	631	50	220	133	300	247	
Plot 3. 3%	205	101	415	145	618	141	217	216	614	297	
Plot 4. 10%	290	50	322	157	583	139	245	275	479	282	
Plot 5. 5%	296	93	356	64	730	74	208	176	623	291	
Plot 6. 3-5-10	* 440	3	429	4	664	12	282	251	548	293	

\* 3% Potash in spring, 5% in summer, 10% in fall.

TABLE 5.—PINEAPPLE ORANGES. (Yields in pounds per tree.)

Plot	Treatment	1924	1925	1926	1927	1928	1929	1930	age
1	Nitrate of Soda	82	95	110	113	168	100	260	132
2	Sulfate of Ammonia	123	129	184	94	160	113	293	167
3	Blood	123	123	132	80	65	122	131	111
4	Combination 1, 2 & 3	61	86	81	170	78	107	132	102
5	* Manure	113	104	95	29	28	29	69	67
6	√ Same as 1	100	112	99	118	127	84	275	121
7	Same as 2	88	116	84	124	103	122	292	133
8	Same as 3	118	123	99	133	90	149	208	131
9	Same as 4	103	105	69	187	95	147	198	127
10	Same as 5	113	114	145	37	53	71	128	94

\* Source of nitrogen changed 1929 to  $\frac{1}{2}$  nitrate of soda and  $\frac{1}{2}$  sulfate of ammonia.

√ Source of phosphoric acid — steamed bone meal.

TABLE 6.—MARSH SEEDLESS GRAPEFRUIT. (Yields in pounds per tree.)

Plot	Treatment	1924	1925	1926	1927	1928	1929	1930	Average
1	Nitrate of Soda	169	276	375	129	173	285	574	283
2	Sulfate of Ammonia	251	160	333	71	90	125	496	218
3	Dried Blood	158	74	220	67	50	20	282	124
4	Combination of 1, 2 & 3	94	265	179	212	57	97	428	190

received the steamed bone meal as a source of phosphoric acid, we find that there is no outstanding difference between the different sources of nitrogen with the exception of manure. This is more apparent when we consider the average yields for the seven years. You will note that the average yield for these plots is the same as for Plot No. 1 or the nitrate of soda plot. The steamed bone meal was apparently responsible for the increased yield of the dried blood and combination plots. Whether this is due to the nitrogen in the bone

son no legume was grown was because we did not want to add another source of nitrogen which would complicate interpreting the results.

You will note that these results cover a ten year period. During the ten years there has been no apparent difference between the growth and general appearance of the trees growing on the plots with steamed bone meal and superphosphate. This year for the first time a difference is noticeable. The trees in plots 6 and 7

(Continued on page 30)

## IMPRESSIONS

(Continued from page 12)

low . . . and those beautiful big colored signs at cross roads, speaking of the virtues of Dr. Harter's Iron Tonic, which had something to do with the thirsts of older folks . . . more pictures in the general store, proclaiming certain peculiarities in connection with Mail Pouch Tobacco . . . Hayner's Whiskey which came mail-order to one of the white hired men in times of opulency . . . a visiting minister who upset everything by not caring to eat chicken . . . bustles . . . and talk of "overskirts" and "Basques" when the sewing circle gathered . . . the wild young scapegrace neighbor who painted the doctor's white horse blue . . . and how the horse nearly died . . . and so did the perpetrator of the alleged joke, after his father's ministrations . . . and, a memory which makes the seat of our trousers tingle yet, the tourist lady's little wooly dog which we clipped and then shaved closely, and which at first she wholly failed to recognize when it came bounding and yapping out to the buggy to greet her on her return home . . .

Farmers in the Sanford celery delta are suffering very serious depredations in their seed beds from cricket-moles, as this is written. Cricket-moles in celery seed beds are nothing new in that area; but this season they are more numerous and destructive than ever. Some farmers feel that this is directly attributable to the depletion of bird life thereabout. The birds, they say, took care of the cricket-mole population and kept it reduced to harmless numbers. It is our notion that humans generally give slight appreciation to the work of the birds in checking insects, else we would now have more birds and fewer insects.

And we have just read that a detour is, "the roughest way between two points." Now that is what we call getting a definition down pretty accurately.

At our house we like grapefruit vinegar. Tropical brand, made by the Powell Florida Vinegar Corp., Miami, is what we have been using for some time. And Granday's canned pineapple, put up by A. Granday Canning Co., Key West, tastes more like fresh pineapple than any we have encountered from outside Florida. Then in canned tomatoes there is a highly superior Florida brand, which at the house we have found most satisfactory, Apte Tomatoes, packed by the Apte Bros. Canning Co. of West

Palm Beach and Miami. This is just an unsolicited boost for three worth while Florida articles which merit the boost on quality alone. We like to see Florida payrolls grow, also.

One telling bit of evidence against the proposed increase of fifteen per cent in all freight rates was given at Washington by a produce man. He told how his company had on April 1 of this year purchased three trucks, costing \$1,092 each, which they have since used for distance hauling. For such hauls they carefully charged the regular rail rates, except upon strawberries which they handled at twenty per cent less than rail rates. After paying all costs of operation, maintenance, repairs, and deducting depreciation, the three trucks had by July 25 earned sufficient net to repay their entire first cost.

Two Princeton undergraduates whom we have had contact with recently impress us as capable of taking up their share of the white man's burden when their turn comes. They are Robert Crutchfield, son of J. S. Crutchfield of the American Fruit Growers Inc. and Frank Chase, son of S. O. Chase of Chase & Co.

Looks very doubtful if there will be any great quantity of Florida orange juice frozen for the markets this coming season. There has as yet been no announcement from the Borden or National Dairy crowds. They went into the thing to try out an experiment; and are not committed beyond that point. These experiments are as yet incomplete; but it is safe to guess that to date they have been unsatisfactory.

Psychologically frozen orange juice got a bad break this summer. In some cities the dairyman was delivering frozen orange juice at 23 cents per pint along with milk at eight cents a quart. The slump in milk prices made orange juice look pretty costly to consumers.

But in the main it looks as if the public just simply isn't going to enthrone over orange juice in frozen form.

Undertaking a campaign of education on behalf of the Florida Citrus Growers Clearing House Assn., Karl Lehmann, for nine years secretary of the Orange County Chamber of Commerce and now the newly elected secretary of the Seminole County Chamber of Commerce, promises to do valuable work. Himself a citrus grower and a most loyal member of the Florida Citrus Exchange, ship-

ping through the South Lake Apopka Citrus Growers Assn., he can be depended upon, we believe, to present the situation in a practical way and to handle the subject in a wholly non-controversial manner. Karl Lehmann is one of the best known personages upon the peninsula, and is a constructive citizen. Incidentally he is not only one of Florida's best public speakers, but is nationally recognized in that capacity. The action of the Seminole County Chamber of Commerce, and of President Papworth of the organization, who incidentally is also a member of the Committee of Fifty, in allowing Karl Lehmann just now to give his time to this undertaking is to be commended.

And in choosing Karl Lehmann to do this work Messrs. Gardner, Morton, Aurin and Kirkland as the membership committee of the Clearing House Association chose wisely and well. Archie M. Pratt, who, we believe, originally suggested utilizing the forceful Lehmann thusly proved to be a pretty smart suggester.

It is our sincere and considered impression that the happiest thing which can happen to this peninsula shortly is to arrive at some equitable and substantial basis of agreement by which the Florida Citrus Exchange, Gentile Bros. Co. and that group of independent shippers looking to Senator J. J. Parrish for leadership, who have never been enrolled in the Clearing House, may be induced to join with those shippers and growers now composing the Clearing House membership, to the end that all may be working harmoniously together for the common good of the industry. Let's trust that is not too much to hope for.

And we make that statement without saying one word, or entertaining a single thought, of criticism for the action of the Exchange, Gentile Bros. or any others in withdrawing from membership.

True there are a lot of details to be threshed out, but, after all, aren't they just details?

Newly compiled government figures tell us that 96½ per cent of the world's commercial grapefruit production is under the American flag. Of this, 90 per cent is grown in the continental United States, and 6½ per cent is produced in our island possession Porto Rico. And the introduction of our personal invention, the non-squirt grapefruit, just as soon as we have it a little further



perfected, promises to help a lot.

Due to continued ill health Dana C. King, for 28 years connected with, and for the past twenty years orange salesmanager of, the California Fruit Growers Exchange, has retired from active work. Modest, retiring and studious, Dana King kept out of the public prints and was little in the public eye, yet California growers gave him large credit for the success of Exchange operations.

And out in California what many seem to hail as the coming citrus cooperative, not in any way connected with the two long existing citrus cooperatives there, is arising in the form of the constantly enlarging Gold Buckle Association. This originally was a unit of the Exchange, and J. S. Edwards, president of Gold Buckle was vice-president of the Exchange. When a few years ago Gold Buckle withdrew from the Exchange, and Mr. Edwards resigned his Exchange position, in a disagreement over Exchange auction policies, it was assumed by some that Gold Buckle would possibly affiliate with Mutual Orange Distributors, the other long established cooperative. Instead Gold Buckle went out on its own, and has been growing like a green bay tree. The most recent addition to Gold Buckle's ranks is the packing house of the Greenspot Citrus Assn. near Redlands and 600 acres of navels formerly going through the Exchange.

C. M. (iner) Berry, president of the Sanford Farmers Exchange, the celery cooperative affiliation of the Florida Citrus Exchange, explains that the name "Miner" is a family name, and he comes by it in that way; but we guess at the real facts. As his guest at Coronado Beach, New Smyrna, recently we found out something. Barefooted he circled the beach, his nose elevated somewhere between a point and a lift. Fascinated we watched. At first we couldn't be sure whether he was imitating a nearby sandpiper or whether the quite active sandpiper was imitating him. But presently he came to an abrupt stop. Sniffing deeply of the ocean breeze three times, he pointed (his finger) at a spot on the sands. Dig there," he said. We dug as directed; and the gold in them 'air hills came up abundantly in the form of countless coquinas, or periwinkles, the quite necessary ingredient of coquina soup. As the champion placer miner of coquinas, we nominate him, and the nominations are

## THE CITRUS INDUSTRY

closed. And it is our hunch that a talent to be so highly developed probably manifested itself in early infancy.

### PUMPKIN BUG CONTROL

(Continued from page 17)

kin bugs, and those were on cowpeas.

One grove down near Lake Wales last year was particularly interesting. The owner had half of the grove planted to spectabilis alone. The other part of the grove was planted to a mixture of *Crotalaria striata* and *Crotalaria spectabilis*. Where he had the spectabilis alone, there were no pumpkin bugs, but where the two were mixed, they were abundant enough to be alarming. They like the pods of spectabilis just as well as those of striata, but spectabilis has pods such a brief time that it don't give the bugs time to raise a generation.

Control: We have outlined briefly the life history of the insect. The eggs are largely laid by the last of September, and the young are in their first stage by the first half of September. So we have always recommended that the cover crop be cut by the first half of September.

Cut the cover crop around the trees first. Where the cover crop was cut around the trees first we have never seen any case of infestation of the fruit where it was cut by the 15th of September, and cut carefully. In mowing a grove, go in there with a scythe first and cut under the trees first, and leave the middles until last. The idea is to drive the pumpkin bugs from under the trees to the middles, so when you do mow the middles the young pumpkin bugs with no wings will have trouble getting to the trees. If you do it the other way, mow the middles first, you are just driving the bugs toward the trees, and some of them may reach the trees. This may be a serious matter if you have early fruit at that time of the year. Whichever cover crop you have in your grove, don't mix them if you can help it, because when you mix them you make conditions just right for pumpkin bugs. Two years ago I was over in a satsuma grove in West Florida. I saw there how a cover crop should NOT be handled. The owner planted a third of his grove to cowpeas, then he had three or four rows of *Crotalaria striata*, and the rest to beggar-

(Continued on page 32)

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Emulso Concentrate is nothing more nor less than concentrated Emulso. We substituted Emulso Oils for part of the water in Emulso. It is a jelly instead of a liquid. You add the water when you use it.

### OTHER NIAGARA PRODUCTS

These include KOLOSPRAYS AND KOLODUSTS, the Bentonite-Sulphur Insecticides; Hardie Sprayers; Niagara Dusters and all kinds of dust mixtures from the factories of one of the largest manufacturers of Agricultural Insecticides in the world.

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**Niagara Sprayer & Chemical Co., Inc.**



JACKSONVILLE, FLORIDA

WAREHOUSES AT CONVENIENT POINTS

# RECENT RESULTS OF FERTILIZER EXPERIMENTS WITH CITRUS

(Continued from page 27)

have a better appearance than those in Plots 1 and 2 which have received the same source of nitrogen. Whether or not this difference is going to continue we cannot predict. It does show the danger of drawing conclusions too soon.

Let us now look at Table 6 giving yields of Marsh seedless grapefruit. Here we find a more pronounced difference between Plots 1 and 2 than in the case of the oranges. While the orange yields showed an increased yield with sulfate of ammonia, the grapefruit shows an increased yield with nitrate of soda. The dried blood evidently is not furnishing enough soluble nitrogen when the trees need it. The combination of sources gives a yield almost as good as the sulfate of ammonia.

From a study of these two tables I do not believe anyone can deny that the two inorganic sources of nitrogen, nitrate of soda and sulfate of ammonia are good sources of nitrogen for citrus. As I stated previously, I believe they will work even better if used in connection with a good cover crop, or with hay hauled into the grove. To anyone who has seen the above grove there can be no question as to the influence of these inorganic sources on tree growth. The trees on Plots 1 and 2 are by far the largest in the grove. One reason why the yields have not been larger may be because we have used insufficient amounts of nitrogen. So far we have given the larger trees the same as the smaller. While this may have been enough for the smaller trees I believe the larger trees can use more to advantage.

There has been considerable criticism about all of our fertilizer experimental work. The chief criticism has been that we are drawing conclusions from a too limited number of experiments. We have been very careful in the past, and will continue to be so in the future, to call attention to the fact that any recommendations we may make are based on experiments on one type of soil and are strictly applicable to that type only. We have stated, and I state now that similar results can probably be EXPECTED on other types of soil, and we urge growers to TRY out our recommendations, tho we will not guarantee that they will get the same results if used on different soil types and root stocks.

Let me assure you and all others who are interested in our work that we fully realize that our experiments

are not as comprehensive as they should be. No one is more anxious to conduct these experiments as they should be than I am. However, it costs money to conduct experiments and few people seem to realize how much it costs or how little we have available with which to conduct these experiments.

The past year we had \$1200 available for the purchase of fertilizers. The fertilizer for the three experiments at the Citrus Experiment Station alone last year cost \$743.36 or more than half of the total amount we had available. Our experiment in Lake County where we are comparing some of the newer sources of nitrogen and determining whether or not it is possible or best to apply all the phosphoric acid and potash in one application a year, cost us \$240 for the fertilizer. This left us only \$317 for fertilizer for the balance of our experiments. These experiments were as follows:

Source of nitrogen test, an enlargement of the experiment under way at Lake Alfred, and amount of phosphoric acid test, five experiments located at the following places: Leesburg, Avon Park, Port Mayaca, Homestead and Fort Pierce.

Satsuma Fertilizer Experiments at Marianna and Penney Farms.

Citrus Fertilizer Experiments on muck soils at Davie.

Potato experiments at Hastings.

Tomato experiments at Bradenton.

You may very well ask the question how could we buy enough fertilizer with the money we had for all of these experiments. The answer is that most of the groves are young trees, one cooperator paid for all of his fertilizer, and we obtained most of the nitrogen materials free of charge through the generosity of the Barrett Co., Nitrate of Soda Educational Bureau and the Synthetic Nitrogen Corporation. I take this opportunity to express our gratitude to these companies for their aid which made it possible for us to conduct as many experiments as we did. This year we may have to ask some of our cooperators to buy some of the fertilizer or discontinue the experiments.

You can readily see that the citrus growers are getting considerably more than their share of the funds available for fertilizer work, yet we are not at all satisfied that we are doing as much as ought to be done, but we do feel that we are doing as much as is possible with the limited funds at our disposal.

One of our greatest needs at the present time is a citrus grading machine at our Citrus Experiment Sta-

tion. We feel that in order to get a true picture of our fertilizer results we should know the effect of the different fertilizers on the size and quality of the fruit. Without a grading machine this is impossible. With our curtailed funds it will be impossible to purchase a grader but we would gratefully accept one as a gift if anyone had one they wished to dispose of in this manner.

## NITROGEN IS MOST IMPORTANT CHEMICAL ELEMENT TO FARMER AGRICULTURAL YEARBOOK SAYS

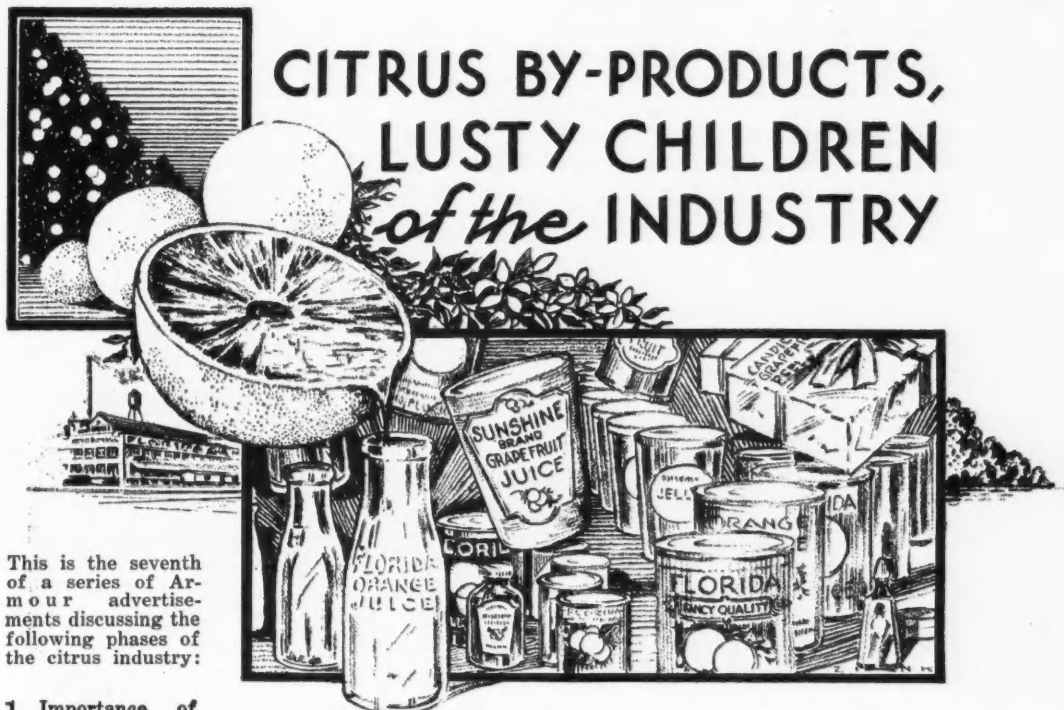
Because it is indispensable to all forms of life and is a principle constituent of protein, and because its primary function is in connection with plant growth and reproduction, nitrogen is probably the most important element with which agriculture is concerned. This is the belief expressed in the 1930 Yearbook of the U. S. Department of Agriculture in an article by Dr. F. E. Allison, senior chemist in the bureau of chemistry and soils.

In the gaseous form nitrogen constitutes approximately four-fifths of the atmosphere but only after it has entered into combinations with other elements does it become a food material for crops. In forms such as ammonia, nitrates, and various organic combinations it is indispensable for the existence of all forms of life. Constant cultivation has brought about a depletion of the supplies by removal in crops, by leaching, and by escape to the atmosphere in gaseous form, the article states.

"Nitrogen is especially needed in the synthesis of proteins, it being present in these substances to the extent of about 16 per cent. Proteins in combination with nucleic acids constitute the most essential part of protoplasm, the material found in all living cells and in which the life processes center. Growth, reproduction, and repair all depend upon proteins and in turn on nitrogen. Chlorophyll also contains nitrogen, and hence even the ability of plants to use the energy of the sun in building up carbohydrates and fats is dependent upon this element," Dr. Allison says.

"Since the primary function of nitrogen in plant tissues is in connection with growth and reproduction naturally the proteins of the plant where these processes are most active are relatively high in this element. In the early stages of growth leaves and growing tips are very

(Continued on page 34)



This is the seventh of a series of Armour advertisements discussing the following phases of the citrus industry:

- 1 Importance of the citrus industry to Florida.
- 2 Nursery stock and young groves.
- 3 Bearing groves and varieties of fruit.
- 4 Harvesting.
- 5 Packing.
- 6 Shipping.
- 7 Marketing.
- 8 Advertising.
- 9 Citrus by-products.
- 10 Salute to the industry.

CANNED and frozen citrus fruits and juices, preserves, jams, candied peel and glazed whole fruit pectin, essential oils and other by-products come from the ripened yield of the citrus grove. Even the fragrance of the snowy blossom is distilled into perfume.

Comparatively unimportant until recently, these by-products have suddenly become lusty children filled with great promise for the future.

Although still in the stage of cautious development, the chief by-products—canned and frozen fruits and juices—may yet become even more important than the mother industry.

New markets, new methods and new products are changing the face of the citrus industry. But one of its basic truths will remain happily unchanged . . . Armour's BIG CROP Fertilizers are unexcelled in producing big yields of quality fruit at low cost.

To the grower who uses Armour's BIG CROP Fertilizers, each new market, each new by-product opens a new source of profit which he may tap with his always dependable crop.

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ARMOUR FERTILIZER WORKS,  
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# BIG CROP FERTILIZERS

Our Florida warehouses are located at  
Winter Garden, Orlando, Homestead, Fort Myers  
Frostproof, Lake Wales, Arcadia and Palmetto.



## PUMPKIN BUG CONTROL

(Continued from page 29)

weed. This was just right for the pumpkin bugs. They started in on his cowpeas in June, and when they had finished these they then went over to his beggarweed

by hundreds about July; when they had finished these they then went over to the Crotalaria by thousands and the pumpkin bugs were so numerous that they took the pods all off and then went on over to the satsumas. Whatever you do, don't mix

these cover crops in your grove, as they will prolong the breeding season of the pumpkin bugs. Cowpeas alone are much better to use than cowpeas and Crotalaria mixed. Beggarweed will come up sometimes in your Crotalaria and it is not as



## Consistent Profit— the reward of fundamental principles in *Citrus Fertilization*

**M**ONEY is made in citrus growing in Florida. This fact has been demonstrated . . . proven by the consistent records of numbers of progressive grove owners who have not quailed in the face of adverse conditions or poor seasons, but have steadily pushed on.

These are men who think in terms of basic principles . . . who put their faith in fundamentals. They know the vital importance of proper plant nutrition. They know a tree nourished haphazardly . . . irregularly . . . insufficiently . . . cannot be expected to maintain uniform, abundant productivity. Never failing to supply their trees with the proper type of nutrition, in the most effective form, they have developed in their groves a powerful reserve of stamina and vigor . . . the one great safeguard against the constant hazards of adverse conditions or unfavorable seasons.

It is no mere coincidence that a large proportion of these outstandingly successful growers have long been regular users of International and Osceola Citrus Fertilizers . . . that for twenty years and more, many of them have never used any other product.

No other fertilizers have been more carefully developed, more thoroughly tested, more conclusively proven for citrus use than International and Osceola brands.

The International Agricultural Corporation's great facilities for research and scientific investigation . . . its vast holdings of phosphate land in Florida and other material sources in this country and abroad, its privately-owned tankage plants, railroads, tank cars, etc. . . its policy of exact adaptation of fertilizers to specific local regions and particular crops . . . its interested and helpful cooperation with all users of its products . . .

These are factors that should be of special and timely interest to every Florida citrus grower. For the development of your grove that will prove profitable through the bad years as well as the good, it will undoubtedly be worth your while to talk your problems over with one of our service representatives. Write us now, so that he may call. You will find him familiar with your problems, his ideas comprehensive, practical and sound.



Check these significant  
*International features . . . . .*

### Abundant Use of All Necessary Ingredients

It is an inflexible International rule that every plant food ingredient essential to the proper nutrition of a given crop, plant or tree, shall be included in all fertilizer manufactured by us for that purpose. There is no deviation from this rule. The ingredients are there, in the finest possible form and quality, and in abundant quantity. There is no skimping, no substitution of inferior or ineffective materials. International's reputation is too valuable to be jeopardized.

### Extensive Resources of International

The International Agricultural Corporation's large organization, able staff of experts and technicians, and great financial and material resources, are important factors contributing to its ability to produce wonderfully superior fertilizers at prices customarily asked for ordinary products. The largest holdings of phosphate rock or any fertilizer company in the United States—its own polish miners in Germany—its own tankage plants, fleet of tank cars, private railroads—these are some features making for International quality and economy.

### Policy of Adaptation to Specific Requirements

Its products are made to meet exact needs in accordance with practical and scientific knowledge of plant foods. Every International fertilizer is specifically designed to meet the requirements of a particular locality and a particular plant or crop. That's why International and Osceola goods always produce results. They are aimed at the mark.

### Service Men Who Know

Each representative of International in the citrus belt is an experienced grove operator, and consequently has a thorough grasp of the grower's problems. Sharing your viewpoint, he is in position to appreciate your situation, to make his cooperation exceptionally effective and advantageous. You will find him interested, competent, helpful . . . a service man in the fullest sense of the word. Let him work with you on your problems.

**INTERNATIONAL AGRICULTURAL CORPORATION**  
MANUFACTURERS OF HIGH GRADE FERTILIZERS  
JACKSONVILLE, FLORIDA

*International and Osceola Citrus Fertilizers*

simple to keep out as it seems.

Crotalaria, if it has plenty of pods on, is more attractive than is citrus fruit, I have seen in groves, over on Merritt's Island where Crotalaria was first used as a cover crop, perhaps a dozen pumpkin bugs on a single pod of Crotalaria, but not a one on a tangerine two inches away. As long as the pods are there the bugs will not leave them for the fruit. Unless something happens to the green pods, such as an early frost, a hurricane—which did some damage two years — or a drought, there will be plenty of pods there. Perhaps the most common cause of trouble is an extremely heavy infestation of pumpkin bugs. After the pods have been attacked by the pumpkin bugs, they will drop, after which the bugs may migrate to the fruit. As long as there are green pods there, you needn't worry about pumpkin bugs. A sure way to get along with Crotalaria, particularly Crotalaria striata, is to mow it in September, or perhaps as soon as it begins to bloom, before it becomes attractive, and you won't have any trouble with pumpkin bugs. Of course, you will lose your seed, and at the present price of Crotalaria spectabilis seed it is rather a valuable crop, but striata seed is not so

valuable.

Now pumpkin bugs have their enemies as well as anything else — especially a large fly much like a deer fly but with short hairs on the legs so that they look like feathers. We have called it the "feather-legged fly". It lays its eggs on the back of the pumpkin bugs and the young grubs hatching out from them bore directly into the pumpkin bugs. They feed at first on the fatty bodies of the pumpkin bug, but finally kill it, although sometimes the parasited bug can lay a few eggs. We will show you specimens of this parasite tomorrow morning at the laboratory. The grub that has lived in the interior of the pumpkin bug completes its development there, and then crawls out and pupates in the ground and comes out as another fly. It feeds on nectar of flowers, and when Crotalaria is in bloom they feed on the nectar in the blossoms of Crotalaria, so we have in Crotalaria a rather happy combination — both a cafeteria and a nursery for the feather-legged fly — here is its dinner, and here is a place to lay its eggs. There is another little parasite that lays eggs in the eggs of the pumpkin bugs. The egg of the pumpkin bug is a pale yellow, turning an orange as they get ready

to hatch, but the parasited eggs will turn black, so you can readily recognize them. This parasite is especially effective in the fall of the year.

A crop of beggarweed and Crotalaria does not always mean pumpkin bugs. My advice would be this: if you have a good crop of Crotalaria spectabilis but mixed with beggarweed or other host, you had better watch it at this time of the year. If you find very many pumpkin bugs there you had better mow it. You had better raise your Crotalaria seed somewhere else and reseed your grove every year rather than run too much risk of pumpkin bugs. If you don't find very many and you have a good crop of pods there, probably you are pretty safe in letting your cover crop go a while. If they appear in any great numbers there later in August or September, you had better mow your striata. This also applies to spectabilis, if it is mixed with wild legumes, cowpeas, or beggarweed. But if you find practically no pumpkin bugs there, and because of the present price of spectabilis seed, you want to save it, you can fairly safely do so. But watch it all the time.

Now if you make a mistake in your judgment and allow your cover crop to stay there in your grove too

# RIPEN COLOR BLANCH



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late, and you find that about the first week in November that the bugs are migrating to the citrus fruit in large numbers, don't hold your hands and say "it is too bad". The bugs can be collected from those trees at a very trifling expense, as compared with the cost of the fruit. At Eagle Lake we collected the pumpkin bugs at about \$2.00 an acre. We made some large nets by stretching unbleached muslin across a piece of wood with a wire around the outside. We had a shallow net about three feet in diameter. When held under a twig with fruit, the bugs will fall into the net when jarred. We had in the net some cotton waste soaked in kerosene. After we got through with each tree we dipped the cotton and the net into a bucket of kerosene and used it over again. This should be done in the early morning when the bugs are sluggish or they will crawl or fly away after they get in the net. Most of this work was done at night. On a moonlight night you can very easily see those white bugs against a yellow fruit.

Now we have no spray that is safe to use on citrus against pumpkin bugs. I have seen pure kerosene used, spraying it on in a very fine mist, but I don't care to recommend it. You may get by nine times out of ten, but the tenth time you may hurt your fruit. The young ones can be killed by the pyrethrum compounds, and the very young ones by the nicotine compounds. Even if we had a safe spray we could collect them in nets cheaper than we could spray. There is no necessity in letting the bugs take your crop if you have made a mistake and allowed them to breed.

#### CITRUS COMMENTS

(Continued from page 18)

the test plot within an optimum range of soil reaction. There is plenty of room for argument as to the most desirable reaction at which a grove does best, but we know that there are a large number of good groves that have been consistently as low as pH 5.00 or even slightly lower in the surface foot and less in the sub-soil areas and also that there are groves that have run consistently over neutral 7.00 that are satisfactory commercial properties.

"Tests run on single trees are of little value because of overlapping of fertilizer effects," is a true statement. There are, however, cases where single tree treatment is preferable at first. These are when simply added to our regular procedure. In this case the material may actually be injurious so we simply add a known

quantity to the tree and await results. One example of a favorable effect is seen in manganese sulphate on marl soils. This material was placed on trees in addition to their regular fertilizer in varying quantities until the amount needed was found. Then it was tried out on larger blocks. It did not give results on acid soils.

#### Records needed:

Comparative plot record and outside record of grove under similar soil and weather conditions covering variety, age and root-stock.

Soil type.

Tree color i. e. leaf color.

Crop condition (quality and quantity).

Season record of general weather conditions; including irrigation where available.

Cost record, covering cost of materials used as compared with outside costs.

Special record of fruit quality if it is a quality test; or of any unusual or different tree effect if it is a new material test.

Complete record of plot is absolutely necessary to check out the best time to use a material and the relation it must bear to other materials. Therefore, time and amount of applications are necessary.

A soil pH reaction (acid or alkaline) is an absolutely necessary part of any test plot.

Interesting investigations that are in the reach of every grower are numerous. A few suggestions that are not complicated and give outstanding results are listed below:

Use of single sources of nitrogen in continuous feeding of citrus trees through a period of year.

Use of newer nitrogen carrying materials in citrus feeding; examples being; nitrate of lime, urea, ammonia gas as used to nitrify low-grade base material or to nitrify acid phosphate.

Use of organics and coarse low-grade roughage.

Use of covercrops in a fertilizer set-up.

Use and | or non-use of phosphorus in super-phosphate or in organic materials.

Applying high percentage formulas and | or straight materials.

Use of potash from its various sources of sulphate, sulphate magnesia, manure salts and muriate.

Use of calcium carrying materials.

Use of special materials such as lime, soda, magnesium, copper, carbon, iron, manganese will call for considerable technical knowledge, and is not a good field of trial except for those in a position to follow

them through very carefully. It is, however, never too late to begin working up a knowledge of soil reaction and tree feeding. The money paying improvements will come from trials made along this line. The more of such work that we do the sooner we will remove some of the guess work of cheaper, more economical fruit production.

#### NITROGEN IS MOST IMPORTANT CHEMICAL ELEMENT TO FARMER AGRICULTURAL YEARBOOK S A Y S

(Continued from page 30)

rich in nitrogen; later, as maturity approaches, the proteins are transported largely into the seeds.

"The effect of an abundance of nitrogen is not only to produce heavy growths of foliage but almost invariably the leaves exhibit a deep rich green appearance. Conversely, nitrogen starvation results in stunted growth and a decided yellowing of the foliage," writes Dr. Allison in describing the effects of nitrogen on crop growth. In only rare instances is the supply of nitrogen compounds in the soil so great as to produce excessive growth of stems and leaves.

The practices to be followed in the application of nitrogenous fertilizers should conform with the functions of the element, and its need under different conditions. "Nitrogen is needed particularly for early growth," the author states, "hence it should be applied to spring-sown crops chiefly at the time of planting. In the case of cabbage, lettuce, hay crops, and other crops grown for their foliage the rate of application may be relatively high. If the growth period for such crops is short, one application may be sufficient; otherwise subsequent top-dressing may be profitable. Where a continuous growth of succulent leaves is desired, as in the case of pastures, frequent applications are advisable if economically feasible."

#### POOR WITNESS

Lawyer (to flustered witness): Now, sir, did you or did you not, on the date in question, or at any other time, say to the defendant or anyone else that the statement imputed to you and denied by the plaintiff was a matter of no moment or otherwise?

Witness: "Yes or no what?"

#### He'd Be Missed

Judge—"Now, I don't expect to see you here again, Rastus."

Rastus—"Not see me again Jedge? Why, you-all ain't goin' to resign, is you, Jedge?"—Capper's Weekly.



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**SERVICE** Field representatives of the Nitrate Agencies Company are doing a splendid job with the unselfish and intelligent service they are rendering the growers of the state. You'll be surprised by the enthusiasm with which they tackle your fertilizing problems and you'll be impressed with the commonsense and practical solutions that are offered by these men who dislike to be classed as "experts."

**RESULTS** The final test of any fertilizer or fertilizing plan is: Does it pay in improved quality, increased yield and lower fertilizing cost per unit of crop? Talk with Grove Owners and Truck Croppers who are now placing orders with NACO for the new season.

This company is fortunate in having more truck fertilizer business booked ahead than ever before . . . **BUSINESS IS GOOD WITH NACO!**

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# Clearing House Protests Increased Freight Rates

The Florida Citrus Growers Clearing House Association, on behalf of its membres and citrus growers of Florida in general, has entered strong protest against the proposed increase of fifteen per cent in freight rates asked by the rail carriers.

Manager A. M. Pratt of the Florida Citrus Growers Clearing House Association, was asked to testify before the Interstate Commerce Commission in Atlanta, on August 18 and 19. Speaking in behalf of Florida citrus growers, Mr. Pratt said:

"With the citrus grower having spent many years in bringing his trees into bearing, he is not going to abandon his grove the first year that it fails to bring returns over cost of production, nor the second or third year. The tendency is to hang on and hang on, spending so far as he is able additional money in fertilizer and upkeep in hopes that the high-price year will finally come which will pay for past losses and again bring in a nice income. The volume of citrus fruits obviously cannot be controlled like vegetables that are planted annually. An increase in freight rates, bringing about an additional cost to the industry must be borne by the grower because the grower never gets anything more than what is left after taking out freight and refrigeration as the biggest item, then packing, marketing, hauling and picking.

"Economically, the grower cannot decline to ship his fruit, even though he knows that the most he could hope for would be a half or one-third of what it cost him to produce it. He has already gone to that expense, therefore, if he sees a chance of getting back even picking, hauling, packing, marketing, and transportation charges, he will take that chance in hopes he might get something above those costs. With citrus fruit being perishable, he is compelled to move it while it is in good condition and he frequently takes a chance and pays red ink on top of absorbing his entire cost of production. This again because he was hoping for more than he could realize after every other factor connected with transportation and marketing had been paid, though he as the producer was the man who created the income from which everybody else profited only at severe

loss to himself. The railroads will for a while continue to get the income resulting from transporting citrus fruit that a grower has raised even though that grower is economically slowly but surely dying and hopes against fate that some how he may survive.

"There is no question but what an increase of 15% in freight rates on citrus fruits from Florida would slowly put out of business many growers that otherwise could survive financially. There is no question but what every possible means will be used by grower and shipper to avoid the additional expense of rail transportation as proposed, by resorting to shipment by water instead of by rail and especially using the trucks much more freely for transportation.

"Should the railroads be successful in getting an advance in freight rates on Florida citrus fruit, it will be at the cost of the growers who already are carrying a bigger burden than they can financially live under. There is no way of shifting this additional expense from their shoulders. The grower gets what is left and what is left is so small on an average that he is already resentful of what he considers a higher freight rate than should be paid. Should he be compelled to accept still further losses for the purpose of increasing the average gain of the transportation companies, most certainly he and the shippers will resort to any means possible to use other forms of transportation than the railroads. And, after a long struggle, the advance in freight rate will have killed off enough investors in citrus property to reduce the volume to a point where the railroads will, in the end, gain nothing so far as the Florida citrus industry goes by having advanced their freight rate.

"The whole issue appeals to the grower as capital against labor, as high finance against the farmer, of an inconsistent attitude where Uncle Sam, through the Farm Board and otherwise, is attempting to bring relief to farmers over the United States and is now asked by the railroads to increase freight rates so that a claimed small earning that has been shown by the railroads in recent years may be increased sufficiently that those who have money to

invest in railroad securities may continue to earn a satisfactory return on their investments at the cost of the producer of the very articles that are feeding the railroads and making possible the earnings they already have."

Conclusive proof was given the Interstate Commerce Commission that a 15% rate increase applied to Florida citrus would not actually increase the railroad's earnings because even under our present freight structure, failed to handle this year an equivalent of 11,748 cars, of which 4,938 cars of grapefruit and tangerines never left the state, and the equivalent of 7,350 cars of citrus were moved from the state by truck. This amount of 11,748 cars which the railroads failed to handle figures a little over 15% of the actual total carlot movement shipped by the railroads and amount to 4,229,000 boxes which would have amounted to additional gross revenue to the railroads of about \$4,000,000 that the railroads failed to secure because the buying capacity of the public has been so low and the expense of delivering to the market so high.

Commenting on a Clearing House exhibit showing bearing and non-bearing citrus trees, attention was called to the fact that even in this big production year, so-called, after applying the 14,205,800 boxes of oranges shipped to the 13,232,295 bearing orange trees in Florida, it

## MID-SUMMER AND LATE-SUMMER SPRAYING

Combined with the natural decline of insect life in mid- or late summer, a light application of VOLCK or VOLCK JUNIOR has proven sufficient for satisfactory citrus scale control . . . . .

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shows an average of less than 1 1-10 boxes per tree, the exact figure being 1.074. In contrast with this, Mr. Pratt called attention to the fact that in California, due to the trees being generally older, the average production per bearing tree for the 1928-29 crop was 1.81 boxes and that it was thought this season's crop would be slightly heavier than the 1928-29 crop. He therefore pointed out the fact that Florida with her more natural climate for producing citrus should be recognized by the Commission and by the railroads as the logical source for increasing citrus supplies, particularly as California was developed from artificial irrigation and that the subterranean water levels of California had been constantly dropping to the point where it was dangerous to all California citrus interests to develop further citrus acreage. Florida, on the other hand, could develop and would continue to develop just as much volume in citrus fruit as the economic survival laws would permit. Therefore, he stated, the most natural and logical source of continually increasing freight revenue should not be killed by penalizing Florida with an additional freight rate.



KARL LEHMANN

Karl Lehmann, Secretary of the Seminole County Chamber of Commerce, will take up his new duties in October. During September he has been invited to arrange a series of meetings of business men, bankers, and citrus growers and shippers, in order that the full importance of the citrus industry to the financial stabil-

ity of Florida may be better understood. The meetings will be handled by local committees; some of them already in touch with Mr. Lehmann. Speakers will be volunteers in all cases. His headquarters for the next four weeks will be in Winter Haven.

#### DAVENPORT GROWERS LET CONTRACT FOR NEW PACKING HOUSE

Organization by the Holly Hill Grove & Fruit company of Davenport of the Holly Hill Citrus Growers association and the award of a contract for a new packing house is announced by Lorenzo Wilson, president.

A contract for the erection and equipment of the packing house was given to the Florida Citrus Machinery company, and a complete Brogden system will be installed. The machinery will include a special sizer for the fancy box trade.

The association has set aside four acres for expansion and expects to produce 300,000 boxes of fruit this coming season.

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ROT OF CITRUS TREES AND  
OTHER WOODY  
TREES IN FLORIDA**

(Continued from page 9.)

good and as productive as the adjoining trees which were not attacked. With but 4 exceptions where trees were known to have been treated previously on account of dead roots, the attacked trees were located solely by finding either fresh or old clusters of the mushrooms of the root rot fungus at the bases (Fig. 1). Upon excavating the soil under the bases of these trees, however, to examine the root systems and prepare them for treatment, a number of the lateral roots were found to be dead in all cases, these often being dead clear back to the root crown and with the terminal portions rotted (Fig. 2). In all but 4 of these 70 trees treated the tap roots were also dead. In some cases an area of bark was found to be dead at one side of the base of the trunk and a slight exudation of gum occurred just above. These areas of dead bark frequently marked the point where a large lateral root had been killed back to the root crown and usually were the places at which a cluster of the fruiting bodies of the fungus had developed.

It was equally surprising to find that oak and occasionally other hardwood root extensively invaded by the mycelium of the *Clitocybe* root rot fungus occurred under each of these citrus trees and that some of these infected roots were in contact with one or more roots of the citrus trees in apparently all cases. The inference is that the oak and other hardwood roots which were left in the land when it was cleared became infected by the *Clitocybe* root rot fungus and that these roots served to transmit the fungus to the roots of the citrus trees. It was also observed in several instances that where an infected citrus root crossed or otherwise came into contact with other citrus roots that the root rot fungus was transplanted to these roots. The majority of the attacked roots of the citrus trees, as well as the old oak roots, exhibited an abundant development of the mycelium of this root rot fungus except in those cases where they were fairly well decayed or the mycelium had run its course. In citrus trees, the fungus rarely develops much above the ground line, although it usually develops upward for several inches on other trees. The mycelium, or vegetative part of the fungus, varies from thin filmy white webbs with a radiating marginal growth to whitish, creamy or old

**THE CITRUS INDUSTRY**

chamois-colored papery layers of extensive development between the bark and the wood and also permeating the inner bark (Fig. 3). Freshly dug roots in which the mycelium of the root rot fungus is still active have a pronounced mushroom or fungous odor. The fungus frequently causes a whitish decay of the attacked roots. In a few instances the lower divisions of the tap roots were still alive and in frequent instances the distal portions of many of the more recently attacked lateral roots still remained alive. The majority of the root infections quite obviously started at point adjacent to the base of the tree, the disease spreading quickly to other roots. When the roots become girdled the ends or distal portions soon die regardless of whether they were invaded by the fungus or not. In several instances narrow areas of dead bark varying from a few inches to a foot or more in length extended along the under side of other portion of the main lateral roots. Such areas were often found to have become delimited by the formation of a calus around the periphery, in which case the mycelium of the fungus appears to die and the dead bark disintegrates and sloughs off.

By the time the root rot fungus has invaded a portion of the root crown and sufficient of the roots to interfere seriously with the support of the top of the tree its decline follows rapidly. The foliage on the most severely affected branches becomes pallid and small and the leaves bleach out along the midribs as is invariably the case with acute starvation induced by any form of girdling of citrus trees. The most seriously affected branches die back rapidly and the fruit produced on these devitalized branches is usually small and frequently drops before reaching maturity, due to the rapid decline of the tops of the tree. By the time the top of the tree has declined considerably basal lesions of dead bark, similar to those developed in foot rot, usually develop at the base and the bark may crack and gum more or less freely (Fig. 4). Dead lateral roots may be evident in many cases, even without scraping away the soil to any particular extent. Such was the appearance of the disease in a number of the trees attacked by mushroom root rot in the grove on Merritt's Island, where a few trees declined rapidly. No infected oak or other foreign roots were found under the 8 trees treated in this grove, although a couple of well rotted pieces of oak were found under one tree and the in-

September, 1931

fectured area in the corner of this grove adjoined a woods in which oak trees were numerous. With the exception of one tree with a twin tap root in which one half was dead, the main portions of the tap roots on these trees were alive.

**Cause**

The organism causing this root rot is one of the gill fungi, *Clitocybe tabescens* (Scop.) Bres., popularly termed mushrooms or toadstools, which occur in clusters comprising several individuals developed from a common base, usually at the base of the attacked tree (Fig. 1 and 5). The root rot caused by this fungus closely resembles in many respects that caused by the well-known honey agaric or oak root fungus (*Armillaria mellea*), especially in regard to habit of growth, the production of rhizomorphs, appearance of the mushroom-like fruiting bodies, and prevalence on land where oak trees have occurred.

The *Clitocybe* root rot fungus is propagated by means of the myriads of spores developed on the gills of the fruiting bodies, by roots that may be in the soil, and by means of the whitish to tan-colored or brownish fungous strands or rhizomorphs which are developed under certain conditions. The latter develop readily in artificial cultures of the fungus (Fig. 6), and furnish one of the chief means of identifying the organism before the mushroom-like fruiting bodies are produced. The rhizomorphs are very inconspicuous and have been observed only occasionally in nature.

Since the fungus can penetrate roots through uninjured bark it must be regarded as an active parasite of living trees, which is readily capable of spreading to adjoining trees, especially where closely planted. It flourishes also as a saprophyte in old stumps and roots of various trees, especially oaks. When the fungus has invaded the roots and root crown of an attacked tree sufficiently to curtail the life processes a more or less rapid decline of the top of the tree follows.

The clusters of the mushroom-like fruiting bodies are produced after the fungus has attained a certain stage of development, provided the moisture and temperature conditions are favorable. The season of their appearance in Florida is chiefly from October to early December. These mushrooms are sufficiently distinctive that they should not be confused with other mushroom or toadstool fungi which may occur around trees occasionally but be without any pathological significance. When fully de-

veloped, the caps are convex in shape, tan-colored, and range from 2-3 1/2 inches in diameter as a rule. The clusters attain their full development within a few days under favorable conditions and decay very quickly in warm wet weather. However, if dry weather follows their development, especially during the fall or early winter, they may dry up and remain recognizable for at least 2 to 3 months, and often much longer, thus marking the tree as undoubtedly one attacked by root rot. In the absence of the fruiting bodies of the fungus the disease appears to be distinguishable from foot rot only by finding the characteristic mycelial growth of the fungus between the bark and the wood of the roots, which is best done in those below the surface of the ground, where better moisture conditions prevail.

#### Control

It is far easier to take steps to prevent the occurrence of mushroom root rot than it is to control the disease after it develops in the trees. In clearing timbered land for grove sites, with the exception of low hammock land where it would be economically impossible, it is highly desirable to remove all roots as thoroughly as is practicable and to prepare the land by deep plowing, which will bring to the surface roots which may have been overlooked in clearing. This is especially important where oak trees occur on the land.

Unfortunately, no work has been done in regard to the possibility of controlling Clitocybe root rot, although about 125 citrus trees have been treated recently in Florida to determine this point. However, considerable valuable experimental work has been done in attempting to control the closely related Armillaria root rot. From the known facts, it would appear that there is but little hope of saving trees attacked by either of these mushroom root rot fungi without careful surgical work and aeration of the root crowns and crown roots, which calls for rather tedious and painstaking work. The mycelium of these root rot fungi is very sensitive to drying out and the removal of the soil from under the bases of the trees so as to leave the root crowns and crown roots exposed for aeration and drying has proved to be very beneficial in checking the development of these root rot fungi, as it has in the case of foot rot in Florida. Considerable experimental work has been done in attempting to control Armillaria and other root rot fungi by various chemical treatments of the soil, both in this country and abroad, but without sufficiently con-

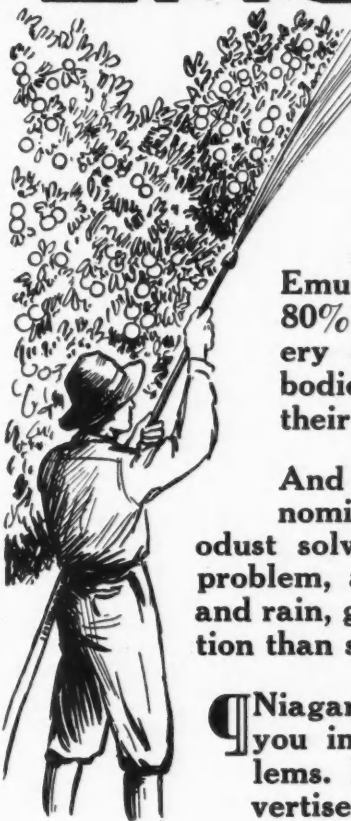
sistent success as to justify any recommendations.

When trees in the grove are attacked by Clitocybe root rot the control measures will be determined to a large extent by the local circumstances. Two main problems are pre-

sented: (1) the prevention of the spread of the disease to adjoining unattacked trees and (2) the treatment of the trees already attacked. Probably the most effective method of preventing the spread of the disease when the attacked trees occur

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in a group is to isolate them by digging a narrow trench of sufficient depth to extend below all the communicating roots and cutting out all roots crossing from either side. The dirt removed should be thrown back on the inside of the area. A depth of from 2 to 3 feet will probably suffice ordinarily under Florida conditions.

In order to be effective, remedial measures must be applied before the disease has progressed to such an extent as to kill a large percentage of the roots and to partially girdle the root crown, since, after the disease has progressed to this extent, the death of the tree is inevitable. Unfortunately, this extent of development of the trouble usually is required before the symptoms of decline develop in the top of the attacked tree to warn the casual observer that something is wrong with the tree. However, attacked trees often can be located quite a while before the tops have declined to any considerable extent, by finding the clusters of the mushroom-like fruiting bodies of the root rot fungus, or sometimes only a slight gumming area of bark, at the bases of the trees.

Unless the top of the tree has declined considerably, the extent to which the disease has attacked the root system can be determined only by removing the soil sufficiently from around and under the root crown and crown roots. This requires removing a basin of soil with a radius of from 2 to 3 feet from the base of the tree, working carefully so as not to injure the roots. Unless facilities are available for washing, the soil should first be worked away from the root crown with a trowel and a pointed stick until a shovel can be used. One half of a posthole digger makes an excellent implement to remove the soil under the root crown when the lateral roots lie close together.

If it is practicable to treat the tree, all dead roots should then be cut out, using a mallet and chisel or gouge to trim them back to the root crown (Fig. 7). Special effort should be made to remove all oak or other foreign tree roots that may be encountered under the citrus trees being treated. All dead roots of either citrus trees or other trees which are cut out should be followed out to the ends and removed in their entirety. All bark lesions that may occur on the base of the trunk, root crown, lateral roots, or tap root in case the latter is not entirely dead, should have the dead or infected bark cut out back to healthy bark and cleaned off down to the wood. Par-

ticular care should be taken to examine for lesions under the lateral roots, especially where these roots leave the root crown. Where lesions have ceased activity and have become limited by a callus formation at their margins it will suffice to merely scrape off the dead bark down to the wood. All pieces and chips of wood and bark cut out should be collected in a container and piled at some convenient place for burning, later. A piece of heavy paper placed under the tree will prove helpful in collecting the chips and small pieces of wood and bark cut out, which, if allowed to remain, may act as sources of infection. All trees not worth treating should be dug up, care being taken to remove and burn all roots. Where attacked trees are removed, it is advisable to leave the excavation open for a few months before replanting.

After completing the surgical treatment of the tree, the root crown should be left exposed for aeration and drying for a few clear days, after which the treated areas should be brushed clean of sand and inspected for any bark infections that may have been overlooked, and all exposed wood surfaces should then be painted with a durable waterproof wound dressing. After this has dried the excavation may be filled in completely or the immediate root crown may be left exposed indefinitely if preferred. If the tops of the trees have died back they should be dehorned proportionately and pruned of all dead wood. The location of the treated trees should be recorded and they should be inspected periodically to detect any subsequent development of the root rot fungus.

## MAYO WARNS FRUIT TRUCKS TO OBTAIN MATURITY PERMITS

Warning has been issued by Commissioner of Agriculture Mayo to trucks to obtain maturity certificates on citrus they expect to move for sale. Guards have been placed on all highways and will demand from all trucks the maturity certificates and satisfy themselves that the tax has been properly paid.

These maturity certificates may be obtained only at a registered packing house, Mayo advised. He said this was not an attempt to restrict movement of citrus by truck but was to see that such citrus complied with maturity standards required of all fruit moved, whether by truck, freight, express or boat.

Truck owners failing to meet requirements of the law may subject their fruit to seizure and destruction, it was explained.

## SKINNER ATTENDED CLEVELAND AIR RACES

B. C. Skinner of Dunedin, Florida, president of the Florida Citrus Machinery Co., flew his air plane to Cleveland, Ohio, recently to take part in the air races being held in that city. Lester Glasscock, pilot for Mr. Skinner, flew from California to Cleveland and took part in the air races at the latter city. Mr. Skinner was accompanied on the trip by Courtney Campbell of Tampa.

**SEED**—Rough lemon, sour orange, Cleopatra. New crop from type true parent trees. Also thrifty seedlings. DeSoto Nurseries, DeSoto City, Florida.

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# **PINK LEMONS EXHIBITED AT NATIONAL ORANGE SHOW FROM FREAK LEMON TREES**

Pink lemons have been found growing on a tree in California.

However, the tree is a rare specimen and the United States Department of Agriculture warns that there is little chance of the pink lemonade industry switching to the new lemons for raw material.

Pink lemons were first exhibited at the National Orange show this year. They came from a tree in Burbank and so far as known, the tree is a bud sport (or freak) of the Variegated Eureka lemon, which was developed from a limb variation of the Eureka lemon discovered in 1911. The Variegated Eureka lemon trees are not as productive as the normal Eureka lemon trees and they are grown chiefly for ornamental purposes.

The pink fruited lemon tree is identical in appearance to the Variegated Eureka tree, but as the fruit approaches ripeness it develops a decidedly pink color in the rind, flesh and juice.

Budwood from the pink lemon tree has been inserted in sour orange seedlings and the resulting trees will be studied to see if the pink lemon can be further propagated. Department specialists declare the pink lemon is another illustration of the occurrence of striking bud variations in this variety of citrus fruit.

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### **REAL ESTATE**

**FOR SALE**—Pineapple land in winterless Florida. \$15 an acre. Almont Ake, Venus, Fla.

**WANT TO SELL HALF INTEREST IN FIFTEEN ACRE SATSUMA BEARING GROVE ON HIGHWAY NEAR PANAMA CITY.** ROBT. LAMBERT, OWNER. FOUNTAIN, FLA.

**SATSUMA BUDWOOD** from Bearing Trees. Hills Fruit Farm, Panama City, Fla.

## **THE CITRUS INDUSTRY**

### **CITRUS JUICE CONCERN SUED BY EXCHANGE**

The Florida Citrus Exchange has filed a declaration in its \$125,000 damage suit against the National Juice corporation, of Delaware, calling upon the latter firm to pay a disputed account amounting to \$120,-862.25.

The suit was first filed Aug. 26 through Attorneys William Hunter, of Tampa, and Treadwell, of Bartow. The National Juice corporation is a subsidiary of the National Dairy Products company, one of the largest corporations in America.

The declaration charges that the juice company purchased oranges from the Citrus Exchange here amounting to \$198,330.12 from January through June. Payments by checks in the sum of \$77,467.87, were reported, leaving a balance of \$120,-862.25.

**WANTED**—To hear from owner having good farm for sale. Cash price, particulars. John Black, Chippewa Falls, Wisconsin.

### **MISCELLANEOUS**

**WANTED**—Packing House manager, for an Indian River district Exchange house. State experience, etc., in first letter. Address H. Care The Citrus Industry.

**DUSTER**, Niagara. Air-cooled engine. Steel truck-mounted. Nearly new. Half price. Samuel Kidder, Monticello, Fla.

**SEEDS**—ROUGH LEMON, SOUR ORANGE, CLEOPATRA. Pure, fresh, good germination. Also seedlings lineout size. De Soto Nurseries, DeSoto City, Fla.

**FANCY ABAKKA** pineapple plants. R. A. Saeger, Ankona, Florida.

**HIGH BLOOD PRESSURE** easily, inexpensively overcome, without drugs. Send address. Dr. J. B. Stokes, Mohawk, Fla.

**SCENIC HIGHWAY NURSERIES** has a large stock of early and late grapefruit and oranges. One, two and three year buds. This nursery has been operated since 1888 by G. H. Gibbons, Waverly, Fla.

**RAISE PIGEONS**—Profit and pleasure. Illustrated descriptive catalogue postage six cents. Vrana Farms, Box 314a, Clayton, Missouri.

**ORANGE PACKERS ATTENTION**:—Two chemical transparent flexible orange coating processes for sale; royalty or license basis. Patent pending. Dr. C. V. Berry, 251 West 111th Street, New York City.

**PUREBRED PULLETS FOR SALE**—White Leghorns and Anconas ready to ship. Barred Rocks and R. I. Reds shortly. Several hundred yearling White Leghorns now laying 70%. Write or wire for prices. C. A. Norman, Dr. 1440, Knoxville, Tenn.

**LAREDO SOY BEANS**, considered free from nematode, excellent for hay and soil improvement. Write the Baldwin County Seed Growers Association, Loxley, Alabama, for prices.

**WANTED**—To hear from owner of land for sale. O. Hawley, Baldwin, Wis.

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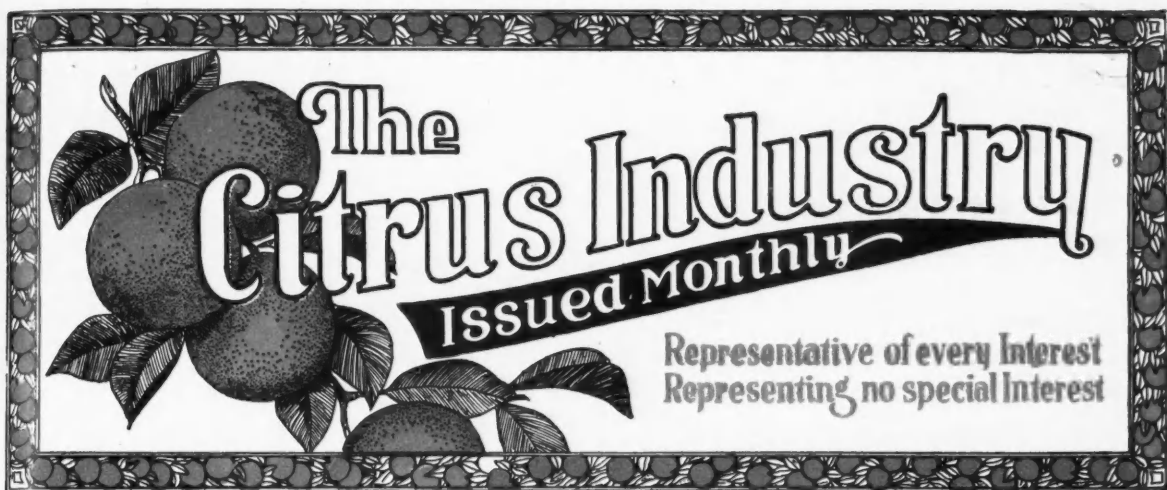
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## Features In This Month's Issue

Inspecting Shipments of Fruits and Vegetables

By Wells A. Sherman

Trade Associations and Business Stabilization

By Frederick M. Feiker

1930-31 Annual Fruit and Vegetable Report

By L. M. Rhodes

Full Text of Texas New Green Fruit Law

Citrus Comments

By Charles D. Kime

Impressions

By The Impressionist

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# A Profitable Hazard

It is common argument of the speculative shipper, whose profits in a big crop year depend primarily on the operation of his packing house, that the grower in dealing with him does not carry the hazard of interest, insurance, maintenance, repairs, depreciation, etc. And it would be a good argument, if true. Fortunately for the growers, however, many of them are realizing the large profits which can be made from an efficiently managed packing operation. They are earning for their own account and placing in their own pockets these packing profits which otherwise would be made on their fruit.

Florida Citrus Exchange growers have learned to welcome the profitable hazard of owning and operating their own packing houses, and they are operating them on a profitable basis.

Grower ownership, it is true, involves some slight individual grower investment in the packing house. It necessitates a responsible board of

directors and efficient management. It requires the payment of interest on the investment, insurance, maintenance, depreciation, etc. But Exchange associations owned and operated by Exchange growers have refunded their members packing profits totalling in the aggregate over \$500,000 on last season's operations.

Just as a few examples, Fort Pierce Association refunded \$88,000 to its growers out of standard charges the past season. The Haines City Association refunded \$60,000; Lakeland Highlands, \$57,000; Florence Association, \$45,000.

True, these are old and well established houses. But then, consider the Lake Placid Association, which refunded to its grower members \$5,000 from its first season's operation at standard charges. The Clearwater Association, one of moderate size, refunded \$7,000, as did the Clermont Association and many others of the grower-owned affiliations.

**Exchange growers have learned that the hazard of ownership is one which they would not want eliminated. It is one which is entirely too profitable—a dividend paying hazard with the dividends paid to themselves.**

## Florida Citrus Exchange

Tampa, Florida